EXPERIENCES OF A PLANTER.

VOL. II.

Vincent Brooks, Day & Son, Lith.

MUNZERABAD AGRICULTURAL CLASSES.

THE EXPERIENCES OF A PLANTER

IN THE

JUNGLES OF MYSORE.

By ROBERT H. ELLIOT.

WITH ILLUSTRATIONS AND A MAP.

IN TWO VOLUMES.

VOL. II.

LONDON:
CHAPMAN AND HALL, 193, PICCADILLY.
1871.

LONDON:
PRINTED BY VIRTUE AND CO.,
CITY ROAD.

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ILLUSTRATIONS TO VOL. II.

The Illustration on the Frontispiece gives the reader a group of men and women of the two agricultural castes in Munzerabad. The two figures on the reader's left are admirably done, and are good likenesses. Of these the one on the extreme left is a vegetarian farmer, who is dressed in cotton instead of with the usual blanket. Next to him is a very fine old fellow of the meat-eating farmer caste, and a very fine specimen of his class too, though rather short. Of the other figures the boy seated on the reader's left, and the man on the right, are far from being likenesses, but the other figures have been successfully copied.

The Second Illustration gives a group consisting of three of the meat-eating farmer caste and a tody-drawer. The figure squatting on the reader's right is a good likeness; the two figures in the centre, who are holding my guns, are, however, not at all successful; and the figure seated on the left, though presenting a fair degree of resemblance, is far from being a good likeness.

The Third Illustration gives the singular cardamom-plant with its seeds, which are borne on racemes running along the ground, and which, by some accident, have been termed rhizomes in the text.

The last Illustration has been really very faithfully executed. My guide, however, has been made a trifle better-looking than the original, and the polyandrous female is (if I may judge by the photograph which I procured when on the Neilgherry Hills) not quite so good-looking as the original.

ERRATUM.

Vol. II., p. 193, line 12, *for* "rhizomes" *read* "racemes."

EXPERIENCES OF A PLANTER.

CHAPTER VIII.

EDUCATION.

DEAN TRENCH has laid down with admirable clearness the difference between two words which are often used as if they were exactly of the same value. He has pointed out that education is one thing, and instruction another; and at the outset of the remarks I have to make on the development of the Indians, I think it necessary, or at least advisable, to clearly define terms that are so often confused.

To educate, then, is simply to educe, or lead out, what a man has in him; while instruction simply means building in, in the sense of furnishing, and is a process like that of loading a ship or filling a cistern. To educate a man is to develop his mental resources, and that can only be done by action. You may instruct, and fill, and load to the brim, with the result, not of opening the fountains of the mind, but perhaps of choking them altogether. Without moral forces and mental friction there may be instruction, but there can be no education. And it therefore follows that a man may be very well instructed, and yet very ill educated. He

may be fully crammed, and yet entirely undeveloped. And, in truth, the education of books is the least part of education. But we may even go further than this, and assert that, as has been well observed, nothing tends to weaken the powers of the mind so much as an extensive course of reading without reflection, or without practically exercising the faculties of the mind. When books are pleasant and plentiful, people will read and read, they will fill themselves and instruct themselves; but in the end they will become like oxen which browse and browse, and require to be ever among the pastures. Reflection, comparison, doubting, consideration, are all more or less troublesome. It is easy to allow ideas and statements of facts to drift across the mind, to believe, and to forget. But the general result of what we call education mainly comes to this, namely, that while a few improve and reflect, the great majority read, and read, and rust. And the reasons for this are sufficiently obvious, for ninety-nine men out of a hundred, or we may even say nine hundred and ninety-nine out of a thousand, have no occasion to really exercise their faculties, and as long as that is the case, unconsciously, and in spite of all his efforts, does man remain mentally in the mud.

Let pressure, then, for one moment, be withdrawn, and the necessities and incentives for exertion be relaxed, and the human animal will steadily drift down the current. He will drop the mental and take to the physical. You will find plenty of savages in North America, and in many a jungle; in the middle ranks of civilised life savagedom materially diminishes; but amongst the idlers in the Row you will find the original animal cropping up with extraordinary severity. In

truth, there is no savage like your West-end savage. This may seem to be going too far, and, in short, to be something approaching to exaggeration. Is it so? Wait a moment. Let us take your savage lounger, with an income above contempt, and below the mark that entails some sort of moral incentive to exertion, and let us glance for one moment at what the man of that description does, and see how far his general liking and pursuits revert to savagedom. The man of that sort likes plenty of animal food, and not a little alcohol, and so, to commence with, does his brother savage. Your fashionable savage loves to gamble, and gamble he commonly does, to the destruction of himself, and often to the ruin of his family. Owing to slightly altered conditions, and to the fact of his natural propensities being restricted by the law, he does not gamble away his wife and scalp, but he goes as far as he can towards imitating his brother savage. The principal pleasure, again, of the savages under consideration is to excite themselves violently, and then lie quiet in a blissful state of repose, lulled and soothed by the fumes of tobacco. Nor, because one man lies on a sofa, and the other on a sand-bank, is the resemblance at all the less perfect. It has often been observed that your gentleman and your jungle savage agree in the suppression of all signs of emotion. They alike excel in their ability to consume putrid meat,—I mean high game. Even as regards the most debasing superstitions has the likeness at least a tendency to resemblance, and the peculiar seat of spirit-rapping and table-turning is to be found in Belgravia. It would be wearisome to pursue the comparison any further, and enough has now been said to illustrate this fact, namely, that if you withdraw the

necessity and stimulus to exertion from Englishmen, the great majority of them will, by a natural process of atavism, revert to the original type of their barbarous ancestors, as readily as the Pariah dog of India reverts to the habits of his wolfish progenitors.

Turning now from Englishmen to Englishwomen, we shall at once have an excellent example of the different results of instruction and education. We take great pains with the instruction of our women, and yet they are, for the most part, entirely uneducated and completely undeveloped. Article upon article, and book upon book, have been written on the subject of female education. Miss Beale, the principal of the Ladies' College at Cheltenham, says that girls leave school too young, and that they are taken home for the going-out stage at the age of seventeen or eighteen. A little later she assumes that a power of thought and independent study would have been gained, a taste for good reading formed, or a love of some special science acquired. In consequence, it appears, of this premature removal, the girl simply becomes bored because she has not adopted the pursuits that characterise superior persons. The appetite for wholesome food fails, and the desire for stimulants is increased. The stimulants are found in foolish novels, silly conversation, petty scandal, sensational dresses, and goodness knows what besides. All these things Miss Beale calls husks, and laments that to be reduced to such food should often be the lot of many a noble character.

By some, again, scientific studies of a physical nature are strongly recommended, and a thoroughly elementary knowledge of such subjects, it is strongly urged, should be let into the mind as deeply as possible. Others are

of opinion that history is especially to be recommended, as having a tendency to lift young ladies into other spheres, and, in short, to carry them clean away from the paltry gossip of the feminine circle. That, at least, will show them that, as the opinions of the past have been reversed, the opinions of the present are liable in turn to the same fate. Then they will learn a lesson as to the mutability of affairs in general, and will, moreover, be conclusively taught not to overvalue things that people commonly attach a great deal of importance to. Then history is somehow to teach them to discern character, a faculty of discernment much needed by young ladies, who are very apt to attach heroic qualities to people who have merely acquired a commanding air by ordering other people about. Some say that women lean much upon clergymen, and that from their lips they will suck in the precious oil, and that therefore you must, above all things, improve, elevate, and enlarge the minds of your parish priests. Others, again, will have it that the governesses are all wrong and contracted, and hence fail properly to expand the minds intrusted to their charge. To remedy this they would like to see all intending governesses sent to college, and prohibit all these from practising the art of teaching unless they could show a satisfactory diploma. This process would at least exclude the incompetent, and secure a fair amount of good average knowledge. Finally and practically come the women of England themselves, and by their own acts proclaim what most people know, but which few are courageous enough to declare. They distinctly and emphatically assert that "improvement for improvement's sake won't work, and can never satisfy us; we want action, and unless we have those

incentives to exertion which men have, we shall stick for ever exactly where we are." It cannot be doubted that they are right, and it is difficult to imagine a harder case. Life slipping away, energies wasted and blasted, and nothing left but the prospect of turning into what, in Scotland, we term an Edinburgh tabby. As a young lady in whom I am interested said to me not very long ago, "It is even better to be married and ill-treated than to be an old maid, slighted if poor, and wished dead if rich." But however all this may be, it is certain that though women may have the education of books, they cannot have the education of life. To them the avenues of ambition are for the most part closed, and they must be content to let their faculties "fast unused," and—that is all that can be said.

What I have just been saying is as old as the hills, but it will serve to illustrate the general principle that man is a natural-born savage, upon whom mere instruction cannot materially act, and who requires constant friction not only to develop his faculties, but to keep them from decaying. Women, as we have seen, not having the opportunities of men, are what they are.

Now, the women of England may think their case a hard one, but I think I can point to one much harder. Women may at least console themselves with the reflection that they may have household duties to attend to, homes to keep in order, the education of children to be commenced, and that, in the ordinary course of things, there is at least a fair chance of their filling a useful position in the society of the State. They may have souls above all this, but they must admit that any necessary duties, however humble, are better than none; and I think I can show them that, comparatively

speaking, their lot is by no means so desperate as many women would like to have it supposed. If it is an advantage to look up, it is also an advantage to look down for one moment, just to see how many are worse off than ourselves; and if the ladies of England will only go with me to India, I will show them entire races of men—of shrewd, keen-witted men—the best of whom are lying like logs, dead and inert, without hope and without incentive, with nothing to do at home, and nothing to look forward to in the world. Now, in one respect, at least, the women of England and the best of the Indians are in the same boat. We may talk of educating them both, but in the nature of things we can only instruct them. The Hindoos at school are apt learners, but when they return to their homes, and when their education is supposed to be completed, their talents seem to be suddenly cut short, and a frost seems, as it were, to cut short and wither up these promising young buds. They talk of improving, of making serious efforts, of pushing forward their countrymen in the paths of progress, and leading forward their race to a glorious inheritance. The literary and scientific triumphs of Europe are to be theirs without effort and with little labour. They lay their hands upon their hearts and say, "Your Shakespeare is our Shakespeare, your Milton our Milton, and your Newton our Newton." To hear them declaim in our language with a fluency and accuracy which we contemplate with envy, it seems difficult at the moment to refrain from believing that the eloquent Baboo is not at once going to start on his career of conquest. But he talks, and sinks back, and ends by doing nothing. Now, this tendency to talk and do nothing has been frequently observed, and so commonly does man take refuge in

supposed inherent differences of race to account for what he cannot readily comprehend, that it has been thought that there must be some fibre wanting in the system of the Hindoos, and that, in short, they are not as other men. But if we would only believe it, the laws of human nature are the same everywhere, and the eternal principle that requires powerful motives for exertion is the same under an Eastern as under a Western sky. Your Hindoo lad goes to school, he is an apt learner, curiosity leads him on, and he rapidly progresses. In a natural state of things, curiosity being satisfied, ambition would take its place, and an honourable career be sought and pursued. Prizes in the army, in the political world, in the law, and in literature would stimulate his faculties, and, in obedience to his natural instincts, he would do what his fellow-man does here. But the prospect of rising to distinction in active life is practically hopeless; and as for literature, to whom is he to address himself? If he writes in a foreign language, no one but a few of his college friends would go to the trouble to read his works; and if he writes in his own, he is necessarily confined to the same narrow audience. The masses are too far below him to understand him, and he would be left to labour for the benefit of the most limited circle of his countrymen. Under these desponding and cheerless circumstances he naturally sinks into a dreary state of indifference. Those faculties which have been aroused by curiosity soon rust, and the state of that man is probably worse than it was at first. Now, our Indian rulers have seen all this; they deplore the existing state of things; and, to do them justice, I believe they are trying to remedy them after their own fashion. With this view they have made a commencement in the only line

that to them seemed a tolerably feasible one. The army they could not open—the higher branches of the law they could not—but they have thrown open the civil service under certain trying conditions, and, at the expense of the lower, they have provided the upper classes with the means of giving their children an advanced course of instruction. They are also doing something in the way of vernacular instruction, and they ultimately hope to carry at least the rudiments of education into the remotest villages. Such, then, and stated as briefly as possible, is the educational policy of the Government. It certainly sounds well, and seems to be complete and rational. But, to any one who has carefully considered the end, a number of the gravest doubts must naturally occur; and I think it, therefore, worth while to inquire more particularly into the results that will certainly come to pass if we fail to alter our method of educating the people of India.

Let us suppose, then, that the Government pursues its present educational policy, that more natives become highly educated, that more and more enter the civil service on terms of equality with our countrymen, and that the deadening effect of want of incentive to exertion is done away with: what, let us ask, will be the result of all this? The general result will simply be, that we shall find that we have abnormally developed the people of India, and placed a more formidable gulf between the upper and the middle and lower classes than could possibly have at any time existed, even if the laws of caste, as expounded by Manu, were to be carried out in all their cast-iron rigidity. If our object is to improve the people of India as a whole, to raise them altogether, to produce an harmonious and even

development, the line of action we are at present pursuing must terminate in bitter disappointment. As well might you expect, by gilding the tops of the pyramids, to arouse the mummies that have slept for centuries below, as expect to make any impression on Indian civilisation by raising a limited and infinitesimal section of the community to such an elevated position in the intellectual world as to be entirely beyond the sympathies and comprehension of those sons of toil who glory in the goad, and whose talk is of bullocks. Instead of the upper classes enlightening the lower—as, in well-constituted society, they invariably should do—we shall assuredly find that they will enlighten them as much as the cotton-planters in the Southern States have enlightened their negro slaves. Nor are we without a prominent example to illustrate what I anticipate will certainly come to pass, unless the rulers of India can be persuaded to give a different bend to the current of intellectual progress. That example I take from Buckle's "History of Civilization," and I do not think I can do better than quote the passage in its entirety:—"The German intellect," says the lamented author of the "History of Civilization," "stimulated by the French into a sudden growth, has been irregularly developed; and, thus hurried into an activity greater than the average civilization of the country requires, the consequence is, that there is no nation in Europe in which we find so wide an interval between the highest minds and the lowest minds. The German philosophers possess a learning and a reach of thought which place them at the head of the civilised world. The German people are more superstitious, more prejudiced, and, notwithstanding the care which the Government takes of their

education, more really ignorant, and more unfit to guide themselves, than are the inhabitants of either France or England. This separation and divergence of the two classes is the natural result of that artificial stimulus which, a century ago, was administered to one of the classes, and which thus disturbed the normal proportions of society. Owing to this, the highest intellects have, in Germany, so outstripped the general progress of the nation, that there is no sympathy between the two parties; nor are there at present any means by which they may be brought into contact. Their great authors address themselves, not to their country, but to each other. They are sure of a select and learned audience, and they use what, in reality, is a learned language; they turn their mother-tongue into a dialect, eloquent indeed, and very powerful, but so difficult, so subtle, and so full of complicated inversions, that to their lower classes it is utterly incomprehensible. From this there have arisen some of the most marked peculiarities of German literature. For, being deprived of ordinary readers, it is cut off from the influence of ordinary prejudice; and hence it has displayed a boldness of inquiry, a recklessness in the pursuit of the truth, and a disregard of traditional opinions which entitle it to the highest praise. But, on the other hand, this same circumstance has produced that absence of practical knowledge, and that indifference to material and physical interests, for which the German literature is justly censured. As a matter of course, all this has widened the original breach, and increased the distance which separates the great German thinkers from that dull and plodding class which, though it lies immediately beneath them, still remains uninfluenced by their knowledge, and

uncheered by the flow and fire of their genius." And if the reader will turn to page 239 of Mr. Buckle's first volume, he will find, in a note, quotations from Laing's "Notes of a Traveller," which will tend to prove how little the higher classes can benefit the lower, if the former have suddenly rushed, as it were, into the occupation of the highest branches of knowledge, while the latter have still but the rudiments of education.

What has happened in Germany, then, will, I apprehend, happen in India. Our efforts to elevate the Indians will simply terminate in an educated caste and an uneducated caste. The former will move in their sphere, and the latter in theirs, and between them will a great gulf be fixed. While the former will develop their faculties and extend their knowledge, the latter will slumber on uncheered and hopeless, and unable to do anything but gaze in uncomprehending wonder at what, to them, will appear to be the actions of beings moving in some distant sphere. And the greater the progress of the advanced Hindoos, the greater will be the evil to the community at large; for not only will the knowledge acquired be beyond the comprehension of those who have the first rudiments of education, but the very language in which that knowledge will be recorded will be entirely unintelligible to the masses. And that this result will inevitably ensue is sufficiently plain from the effects which, as I have shown, have been produced in Germany. Nor in India itself are we without an illustration of this tendency, where, from the short-sighted folly of man, a people has been irregularly developed, and where, from various causes, the higher classes have not sought an audience amongst the lower. At the present moment, the Canarese language spoken

amongst the more advanced classes is almost entirely unintelligible to the middle and lower ranks of the community, and, in short, is to them what the language of the advanced classes in Germany is to the middle and lower classes of that country.

I have said that the greater the progress of the advanced Hindoos, the greater will be the evil to the community in general. But we may, I think, go a step further, and say that the evil will not only reach the lower classes, but that it will also affect injuriously the upper classes themselves; for, were the lower classes able to comprehend the upper, that community of feeling that would then exist would arouse, I will not say that patriotism, but that feeling of sympathy, which is the most powerful stimulus and incentive to exertion. The knowledge that a man was addressing an extended audience, consisting of millions and millions of his countrymen, would produce in him an ardent enthusiasm which would attract to the paths of knowledge those agricultural classes who are at present slumbering in the sleep of ignorance. Nor can it be doubted that, if the curiosity of the multitude was once aroused, an extraordinary effect would thereby be produced amongst the educated classes themselves. They would then have a great and noble object. To compose in the vernacular languages, in a style that would be easily comprehensible, would then be an object of the first importance. It would be a source of pride and satisfaction to the leading men of each country to excel in the use of their own mother-tongue, and their faculties would be at once awakened and stimulated by the fact that their books were to be had in every village, and brought home to every hearth. Such reflections as these would give an aim and direction

to the efforts of the intellectual classes, who would no longer feel that they were merely improving for improving's sake, but with the object of enlightening the minds of the people about them, and raising them to better things.

Enough has now been said to show the reader the state of things as they are at present, and the state of things that, I anticipate, must come to pass, if the rulers of India persist in pursuing the educational policy they have adopted. Before, however, proceeding to point out those measures which should be adopted with the view of developing evenly the Indian in general, it may be as well to recapitulate, as briefly as possible, the ground we have gone over, and the points which I assume to have been established.

In considering, then, education in general, we came to the conclusion that the education of books is the least part of education, and that in no case can the faculties of a people be developed without the aid of powerful incentives to exertion. We have seen that instructed Hindoos do not advance beyond a certain point in consequence of the absence of incentive, and that when they leave school those faculties which have been aroused by curiosity soon rust and decay. We have also seen that the Government has adopted measures by which incentives will be provided for the enterprising and ambitious of the better classes. And we have assumed, further, that, this policy being pursued, more and more of the Indians will enter the civil service on terms of equality with ourselves, and that, consequently, more and more will become highly educated. We then inquired into the probable result of this policy on the community at large, and came to the conclusion that it would simply result in a very

small section of the people being highly advanced, while the masses would remain sunk in ignorance; and it was shown that the more highly educated the upper classes were, the worse it would be for the peoples of India. We have also seen that the result of the lower classes failing to comprehend the actions, and even the language, of the upper, must inevitably terminate in injury to the educated classes themselves; and the general conclusion we came to, after taking all points into consideration, was, that it is a mistake to place the foremost men in a society above the sympathy and comprehension of the masses, and that, in short, to develop a nation advantageously, you must develop it evenly.

If the preceding conclusions are correct, it follows that our educational policy in India requires to be entirely reconstructed, and from the remarks made by the press, and that have been let fall occasionally by our Indian rulers, it is evident that a feeling to that effect is commencing to make itself felt. There is an indication that the ridiculous notion of knowledge filtering, as it were, downwards, and so irrigating the masses below, is already commencing to be exploded. There are indications that the experience of the past, and the history of nations and peoples, are at last about to guide our governors for the future. It is melancholy indeed to find that Government again and again repeats the history of individuals. The accumulated wisdom of ages for the guidance of man in all the affairs of life, all the wisdom of Solomon, and the proverbial experience which each people hands on from generation to generation, are thrown away on individuals. Each man, in spite of all that has been written and spoken, will insist on working out his own experience to the bitter end. And thus it is with those who have it

in their power to influence the fate of others. Driven on by the exigencies of the hour and the clamour of the people who at the time have most power to make themselves heard, the governors of men drift on with their eyes steadily fixed on anything but the ultimate result of the policy they are pursuing. The eloquent Baboo, knocking at the door of Government House, and urging his claims in grandiloquent Johnsonese, has produced a wonderful effect on the action of Government; but who will hear the voice, or rather represent the wants, of the poor? Who will dare to neglect these splendid phrases, with their sesquipedal words, and, fixing the eye steadily on the requirements of a people, march on steadily, unheeding the clamours of the ignorant, and uncheered by anything but the reflection that his labours will bear fruit when his name will have been forgotten? It is almost too much to expect this in any country, but when these labours are to be incurred for the people of a foreign country, and amidst the depressing feelings occasioned by a debilitating climate, the wonder is, not that more has not been done, but that so much has been achieved. And when we come to consider, further, that in this country, from whence ought to emanate a more statesmanlike policy, the thoughts of men are absorbed in the questions which have naturally most interest for the public mind, it is no longer a matter of wonder that the interests of a distant empire should be uninfluenced by the only power that can make itself felt. Under these circumstances it is hopeless to expect that the schemes I have to propose will receive one moment's attention. I do not expect they will; but I shall not, therefore, be deterred from expressing them.

The object I have now in view is to lay down as clearly as possible a plan for developing the faculties of the people of India considered as a whole—to develop them in such a manner that the upper classes shall act on the lower, and the lower again on the upper; to diffuse information on political, social, agricultural, and manufacturing objects; to provide a machinery by which the intentions of the Government shall be clearly and regularly explained to the people, and by which the people in turn shall be enabled to make known their wants to the Government, and supply information as to the practical working of its enactments.

With the view of accomplishing these objects, I would divide the whole of India into educational districts, to be bounded, as far as practicable, by the language spoken; namely, I would take all the Canarese-speaking districts, and make the head-quarters of that educational department at some large town as nearly as possible in the centre of the country where Canarese is spoken. The same with Teloogoo, and Tamil, and other languages. At each of the educational centres I would establish a college, with the sole object of improving and developing the vernacular language, and especially with the view of creating a pure and lucid style of writing which should be readily comprehensible by the agricultural classes.

In the second place, I would establish an entirely vernacular school at the head-quarters of each county, and I would compel each village to supply two farmers' sons to attend regularly, with the exception of the time when their services would be required for the sowing and harvest work. And I would make these boys the medium of communication between the Government and the people. I would supply them with books on agri-

culture, on improving the breeds of cattle, and on the introduction and cultivation of new plants, especially the cinchona and other medicinal plants. These books I would allow them to take home on Saturday afternoons, and thus would be conveyed regularly and constantly a stream of intelligence on these subjects which would arouse the agricultural mind, and stimulate a desire for improvement. I would also make these boys convey intelligence of Government enactments, and I would encourage them, on their return from their homes, to communicate the thoughts and opinions of their families to the head of the school. I would thus endeavour to give a reality and purpose to education, without which the acquisition of knowledge is at once difficult and useless, and disseminate intelligence of every possible kind throughout the remotest hamlets.

In the third place, I would make the county schools and the college at the educational centre the sole avenues for admissions to the public services. Those who had passed satisfactorily through both would, of course, be eligible for the highest posts that natives could attain to without a knowledge of English; while I would give opportunities of employment in the lower grades of the service to those who were not inclined to go further than the county-school education. And supposing that they were afterwards inclined to attempt the higher branches of the service, I would allow them to rise, subject, of course, to examination as a test of their abilities.

In this scheme the reader will observe that I take no notice of English education, and I do so for this reason, namely, that I consider the encouragement given to English education will widen the distance between the masses and the educated classes. In any case it must

be positively conceded that, as English never can be known amongst the agricultural classes, to unduly encourage it will only be to lessen the progress that ought to be made in those vernacular tongues through which all intelligence must be conveyed. It must not be supposed, however, that I should not like to see a fair proportion of English education; but I consider that quite enough has been already done to start that branch of instruction, and I would, therefore, leave it for the future to be paid for by those classes who, for objects of their own, desire to be acquainted with our language.*

I have stated this plan for an educational system as briefly as possible, and have purposely avoided going into a consideration of the numerous difficulties that would have to be encountered, but which could readily be overcome. I have avoided all this, as my object here is to point out merely the groundwork of what is needed. Let the principles and general method once be admitted, and the rest will be easy. Once let the natives of the agricultural classes be supplied with motives for developing their natural intelligence—once let them understand that their gains will be increased, their comforts extended, and their health conserved by new methods of cultivation—once let them clearly see that progress in the service of the State will be the sure reward of industry and energy—once provide that food which will create an appetite for improvement, and improvement and development will surely follow.

It may be observed that the methods which I suggest for arousing the native mind are entirely based on the idea that education and knowledge are to develop directly the material prospects of the people; to add

* See Appendix A.

to their prospects of making money; to improve their agriculture; to improve their favourite animal, the cow; to provide them with means of alleviating disease by the introduction of medicinal plants; and to introduce, in short, every means and appliance that can either alleviate pain or add to the enjoyments of life. Unless education is thus brought to bear directly on their material interests, and unless it is daily inculcated that wealth and comfort are the main ends of instruction, all our schools in the agricultural districts will come to nought. To people looking on from a distance it may appear that you will have done a great deal when you have taught people to read and write, and when you have provided vernacular schools in every village; but I feel well assured that you will simply have done nothing at all. If mere instruction is easily let into the mind, it is far more easily let out. And that this is the case I have had ample evidence. Amongst the well-to-do farmers in my neighbourhood it is commonly the custom for several of them to club together, and employ a tutor to teach their children to read and write Canarese; but when all that is done, they having nothing to write about, and having no books of any practical interest to read, soon fall into the same state as those who have had no instruction at all. And it requires no great amount of penetration to foretell that this result will always recur until a practical literature is started, which shall be adapted to arouse the attention of the people, and which shall treat of all those subjects which come home to them in every-day life. There is no use whatever in merely shooting down a lot of instructive bricks and mortar when you want to erect your educational edifice. And though this process may produce a trifling effect in the centres of life, and in the

large towns of India, it will assuredly not answer at all amongst the rural populations in general.

I have now said that nothing can really be effected amongst the people unless some practical literature be started amongst them which shall powerfully attract their attention. But how is this elementary and practical literature to be started, and where are you to find the writers? It is evident that writers will not spring up in a day, and though in time they will, no doubt, arise, when the demand for books commences and increases, it is plain that the initiatory books must be written and printed at the expense and through the agency of the Government. And though this may seem a laborious and uphill task, it is just one of those tasks which must be gone through, if our efforts are ever to be crowned with success. These difficulties should be looked fairly in the face, and it should be distinctly recognised that to lay broad and deep the foundations of national progress is not the work of years, but almost of generations. When, however, we come to contemplate such stretches of time, the mind is half inclined to shrink from the task; and the temptation to snatch at the showy and evanescent results which can readily be obtained by scratching at the surface of society is naturally so strong as almost to be irresistible. Hitherto the temptation has proved to be quite irresistible, and as long as the upper classes of the Indians can make their wants felt, while the lower work on unconscious, unheeding, and unheeded, the direction of the intellectual current will continue unaltered, and the breach between the educated and the uneducated will widen and widen, until, in the end, we shall have produced a more disjointed example of civilisation than has ever been brought about since the world began.

CHAPTER IX.

NATIVE AGRICULTURE.

If many delusions exist in this country as regards the Indians, there are, if possible, still more existing in the minds of Anglo-Indians as to the state of things which exist in the country of their birth. To hear the Englishman in India talk, you would imagine that in this happy land was to be found everything that was good, and true, and beautiful; that our drugs, our morals, and our food were alike pure and unadulterated; and that here all the resources of art and skill had been brought to bear on every conceivable difficulty, till there remained nothing now to do but to sit down and enjoy the fruits of all those things that had been effected by the efforts of enlightened Englishmen. And, in order that they may be quite consistent, our countrymen carry with them, as regards our agricultural skill, a belief which is equally soothing and exhilarating, and a firmness of conviction which supports them in making the boldest assertions as to the badness of Indian, and the perfection of English, farming. The size of our cart-horse as compared with the Indian bullock, the very weight and dimensions of our implements, and the magnitude of our agricultural operations, when contrasted with those puny Indian farms, are facts which require only to be mentioned in

order to carry conviction into every heart, and to silence every doubt. To inquire and to observe is therefore needless, and nothing remains but to teach. It is sufficient for your Anglo-Indian, as he toils along some dusty road, to glance at the Hindoo peasant with his plough on his shoulder, to see the faint furrow that is traced on the hard and uncongenial soil, to observe those greyhound bullocks of puny build, and to conclude that these, being unlike English cart-horses, plough, and steam-engines, further examination is therefore needless, and that, as the Hindoo will slumber on as he has done for the last two thousand years, it is hopeless to try and improve him. Some, however, being bolder and more energetic, are determined to arouse these slumbering peasants, and the rage for creating a new state of things forthwith commences. No longer is the humble ryot to trace these faint furrows, nor to tread out the corn with his cattle, nor to burn his manure for fuel, nor to pound and grind his corn. The sanguine improver looks forward, and fondly hopes to see the day when the sound of the threshing machine shall be heard in the land, when ploughing shall result in a furrow broad and deep, when manure shall be carefully stored and utilised instead of being burnt for fuel, and when the hum of the water-mill shall succeed to the drudgery of pounding and grinding that corn which must now be converted into flour by the maidens and women of Hindoostan. But the ardent mind rushes on to triumphs far transcending these, till reaping machines and steam-ploughs are talked of as things that those now alive may live to see in daily use. Filled with a generous enthusiasm, your Anglo-Indian resolves that something must be done, that machines must be got out from England, and a serious effort made.

And the machines accordingly are got, and the experiments made, and—the delusion is gathered up and put away, and you hear no more about it.

But still the cry goes on; the error, once started, continues to be propagated, and again and again do you hear from every side an echo of this very ancient tale. In a single day have I seen this lament raising its dreary wail in journal after journal. Improvement in agriculture, says the *Times;* improvement in agriculture, says the Asiatic; improvement in agriculture, says the enlightened Parsee, is one of the principal things we must look to for at once developing the resources of the soil and increasing the prosperity and revenues of India. Year after year have I witnessed the expression of those yearning desires for improvement without attempting to arrest, or at least to modify them; but the time for trying to dislodge these old illusions must no longer be deferred; and, at the risk of drawing upon me the opposition and censures of those ardent Hindoo improvers, I must now speak out, and endeavour to place this subject on a satisfactory footing. And, accordingly, I shall attempt to show what the Indians can and do effect, what it will not pay them to alter, and what improvements can be recommended with a reasonable prospect of success.

Before, however, commencing to do this, I think it advisable to (what I am clearly of opinion should always be done at the outset of every paper, book, or essay on India) give the reader an account of the opportunities I had of forming correct conclusions on the subject. In the second place, I think it may be useful to look at home just to see what we are doing now, and what we are failing to do, in agriculture. And, in the third place, I shall address myself to Indian farming.

And, first of all, as to my opportunities of forming correct conclusions. As to my own agricultural knowledge I may safely say that I am, to use a favourite native expression, merely an ignorant boy. It is true that I belong to a good agricultural county in Scotland, that I observed things, I think, with a good deal more interest than the general run of people do, and that I probably know more about agriculture than your Anglo-Indian generally does. With the aid, too, of agricultural works, and by dint of hard questioning and personal investigation in the country of Mysore, it is probable that I might unaided have formed a fair opinion. But I certainly should not have ventured to speak in a tone otherwise than doubtful and diffident if these were all the claims I had to a hearing. The opinions and experiences I have now to lay before the reader are certainly the result of my own conclusions, but they are confirmed and ratified by the judgment of an experienced and practical Scotch farmer, a man of such unusual intelligence that, in the course of a few years, he was allowed to be one of the first, if not the very first, planter in Mysore. This gentleman, whose untimely death was lamented by the natives almost more than by the Europeans who knew him, was of a Berwickshire farming family. He had been a factor, and when he entered my employ, was farming, conjointly with his brother, in my own county. He did not leave Scotland till he was in his twenty-seventh year, and as he was a man of naturally acute observation, and of unusual energy and industry, it may be supposed that it would be difficult to get a better and more practical opinion. These details may seem to require an apology for their minuteness, but if every writer on India would be only as minute, the

English reader would at once know what value to attach to the assertions that are so often printed, and would, in short, be placed in a much more satisfactory position than he is at present.

Having thus indicated the base I am going to work upon, I shall now proceed to offer a few general remarks upon agriculture in this country. And in making these remarks I may mention, first of all, that I am mainly guided by Mr. D. Macdonald, whose able work on Farming and Estate Management has run through so many editions; but I have also made use of information from various other sources which I think it unnecessary to specify.

What I have now to say as regards agriculture in these islands I limit entirely to England, which has not yet made that approach, not to high farming, but even to that fairly good farming which is to be met with from one end of Scotland to the other. When remarking upon any state of things existing in a country, it may seem unfair to select the worst points and the most backward districts for criticism, and to leave on one side that part of the island where things are to be seen at their best. But my object in saying anything about English agriculture at all is to show people who have gone, perhaps, straight from an English town to an Indian village, that the ideal good husbandry which they have heard of as being so universal in this country is by no means common, and that bad husbandry rather than good may be said to be the rule. This, however, is not the only object I have in view while pointing out the defects of English husbandry, and I am principally induced to paint things as they really are, with the view of lessening that ignorant feeling of superiority which

so often ends in a universal habit of decrying, or even refusing to examine, anything that has been adopted by the Indians, because it must necessarily be quite behind the times. And if I can succeed in at all lessening that tendency, I shall have gone a good way towards helping on the adoption of such improvements as are really practicable. When you laugh at a man's implements, ridicule all those notions which have been handed down to him, and vaunt the superiority of your ways and your machines, you have fully prepared him to resist the whole of your proposals. He will probably, and, as regards Indian agriculture, he will certainly, see that some of the things he does must be right, and cannot be altered, and that so far you must be wrong; and returning on you the position with which you started, he will be just as much inclined to ridicule you as you are to ridicule him. But if the Englishman was at all conversant with the real state of things in this country, he would not only be better able to judge, but far better able to teach something really to the point. He could tell the Indian that in England there were bad as well as good cultivators, and that the bad much exceeded the good, but that the bad farmers were fast learning from the good, and that the science of agriculture is as much in a progressive state here as it always must and should be all over the world. And the Englishman would then be in a position to praise what was good in native agriculture, and, by praising the good, he would more easily pave the way for the introduction of those improvements that are practicable. Having thus explained the objects I have in view, I now proceed to point out a few of the leading defects of agricultural practice that are so frequently to be met with in the southern portions of this island.

The best proof we have of the inferiority of farming in England, considered as a whole, is the remarkable and interesting fact that the bleak, cold lands of Scotland, with every disadvantage of climate, rival, and even eclipse, in producing powers the more highly-favoured climates of the south. Man in the north, stimulated by competition, and by the advantages of high rents, has actually wrung from niggard nature a greater proportionate return of food than can be produced in the south; and it has been conclusively shown that even the inferior soils of Scotland yield a greater average quantity of food than is produced on the average of all the soils in England, including both inferior and superior. But it is impossible even for the most ordinary and superficial observer to fail to notice, as he travels from Scotland to England, the melancholy signs of barbarism which so frequently meet the eye—the long trains of horses, the undrained land, the small fields, the luxurious hedges, the waste of power, the squandering of manure, the clumsy waggons, the horses loaded with the weightiest harness, and the wretched boys, who ought to be at school, spending the livelong day, whip in hand, struggling through the clay. Without entering into too much detail, we may just notice, as we pass along, a few of the effects that arise from the evils alluded to. And, first of all, let us consider the effects of the small fields and those cumbrous cavalcades we so often see in the south of England. At a single glance the loss of time in turning both plough and horses in a small field is the most obvious matter calling for remark, and the following facts will show the reader the immense loss of time incurred in turning even an ordinary two-horse abreast plough; and, if that is the

case, I need only leave him to judge of the loss of time that must ensue when three horses in a row have to be got into position for a fresh start. Supposing, then, that you have a ridge 78 yards long, the time lost in turning comes to no less than 5h. 11m., or rather more than half of the ordinary ten-hours day's work. If, however, you extend the length of your ridge to 149 yards, you will only lose 2h. 44m.; and if to 274 yards, the loss will only amount to 1h. 28m. per day. And this loss of time occasioned by having frequently to turn, in consequence of the smallness of the fields, is only one of the losses to be incurred. When we come to consider the waste of labour and the waste of power arising from the long team, we are more than ever struck with the dense obstinacy which in this nineteenth century, and in this enlightened country, will persist in neglecting all the laws of economy and all the laws of draught. For, by employing this long draught-line, a great deal of the strength of the horses is wasted in pulling one another, and a man and boy are at least required, and sometimes even more than this, for the management of the plough and team, whereas the whole of this work could be as efficiently performed by two horses yoked abreast, and driven by a single ploughman.

Amidst the outcry against shallow ploughing in India, it is interesting to find that this "is indeed one of the most crying evils of English agriculture;" and equally astonishing is it to find the number of arguments that are again and again adduced to show the advantages of deeply stirring and minutely dividing the soil in order to expose it more fully to the action of the air. Nor is it less surprising to find that, with every mechanical appliance at command, the traditionary waggon, with its

creaking wheels, still toils along many a rough farm road, and that the horses which drag it are still loaded with those standing-up capes, which only add to the weight of the collar and the general obstructions with which the perversity of man clogs the forces at his disposal. But if the harness and draught appliances in general are freely to be criticised, not the less are the farm-steadings, where manure is allowed to run so freely to waste, and where that ammonia, which ought to furnish food for growing crops, is left to poison the air which has to be breathed by animals that ought to be provided with the purest atmosphere. And how often do we see in the arrangement of the buildings, and in the want of ventilation and drainage, a lack of attention and a carelessness as to consequences which seem to indicate that the agricultural race is at once slovenly and barbarous! Then there are those foul, dark stables, which exclude the light so completely as to injure the sight of the horses, and to cause an ample source of irritation when the animal is suddenly taken into the full glare of day. Another evil, too, which seems likely to cry aloud for many a long day is the waste of seed, which is often sown in prodigal quantities, and without the slightest reference to the poverty or richness of the soil. Look even at the good old English hedge, that exhauster of plants that grow near it, the harbour for insects and vermin, the obstacle to the circulation of sun and air, and last, though not least, consider for one moment what thousands of acres are needlessly occupied, to the loss of the country and the detriment of both landlord and tenant. And then in the hedgerows we have trees which afford no shelter, and whose shade are injurious to the plants within their

influence. Nor, because we diminish our hedges by one-half, and do away with our hedgerow trees, need the country be made any the less beautiful; for large fields, with trees massed into plantations at intervals, are at least as pleasant to look at as those cramped divisions which suggest nothing but worry and confinement.

When we turn, again, to the consideration of drainage, or rather the want of it, we are struck more forcibly than ever with the extraordinary stagnation and want of enterprise displayed in many parts of England; and the general result of the losses arising from the neglect of it may be briefly summed up by observing that, were the lands in this country perfectly drained, the annual produce might be increased by at least fifty per cent. Nor is this actual loss of produce the only evil arising from undrained or imperfectly-drained land; for a variety of diseases that occur in sheep and cattle are distinctly to be traced to the land being inadequately drained; and insects, both creeping and flying, add to the general list of evils by tormenting both man and beast. To crown all, I may add, that deficient drainage entails sticky roads, and horses exhausted in dragging their loads; that the air is rendered damp and chilly; and that fever and rheumatism too often complete the list of evils enumerated.

To glance at another defect in our English agricultural system, I may briefly allude to the enormous waste incurred in feeding animals on the land instead of under cover, notwithstanding that our own experience, as well as that of the Americans and Flemings, has placed beyond all doubt that you cannot waste your land more effectually than by feeding your stock upon it. In cow-feeding especially it has been decisively shown, by

experiments extending over, in the aggregate, fourteen years, and which were conducted by Dr. Rhode-Eldena, of the Royal Academy of Prussia, that cows fed in stalls pay better than if fed on land in the usual way. There is a saving of grass, which is damaged when lain and dunged upon; there is a saving in fencing; there is an increase in the milk, amounting to about one-third; and the health of the animal remains unimpaired. And not only do you waste your land, but, where fattening is the object in view, you waste an enormous quantity of food, in consequence of the animal to be fattened requiring more nourishment when cold than it does when comfortably warm. This can be shown theoretically with ease, but it has also been shown practically that a sheep in a shed will eat half as much only, and gain more weight than one unsheltered.

In concluding these trifling remarks on a few of the many defects that can be pointed out in English agriculture, I think it may not altogether be superfluous or uninteresting if I point, for one moment, to the very recent date that must be affixed to the improvements that have been effected in this country. The reader who feels interested in this subject may be referred to an interesting article on "Agriculture" which appeared in the *Edinburgh Review* of January, 1866, and it is from the journal in question that I take the following facts. It appears there that the most important agricultural improvement in England can date no further back than 1838. In that year the Royal Agricultural Society came into being, and we find Mr. Pusey, in the first volume of the Society's *Journal*, advocating the ridge system of turnip culture instead of the broadcast system then prevalent. He also informed the public that "the

use of another machine, by which seed is laid in regular rows, has lately become frequent, though it established itself so slowly that for a long time travelling machines made yearly journeys from Suffolk to Oxfordshire." But what will appear still more extraordinary, when I come to speak of the machines that have been used for thousands of years in India, is the unfeigned delight and satisfaction with which the reviewer himself regards the invention of this important machine. We are informed that the triumph of Vulcan and his aid to Ceres were never more conspicuously shown. "The mechanic," says the ardent reviewer, "was requested to construct a machine capable of depositing any sort of seed, in known quantities, at a regular depth, in parallel lines of optional distance from each other, with or without manure; and lo! that wonderful invention, the drill, in the absence of which our present clean and orderly system of farming would be impossible." To revert again for one moment to Mr. Pusey, I may observe that in the *Journal* alluded to, he talks of draining in a doubtful vein, but contends that land should be drained to carry off surface water; and he also speaks of bones as applied for the first time in 1835.

I think I have now said enough to show that our agricultural improvements are neither so marked nor so recent as they are generally supposed to be; and I shall now turn the attention of the reader to the agriculture of the Mysore province.

When I first came to notice agriculture in Mysore, the first thing that occurred to me, after observing the admirable drill husbandry of these plains, the way in which the crops are kept so thoroughly clean, and the fine state of comminution into which the soil is worked

for the preparation of the seed, the first question that naturally arose in my mind was,—Whence have our people, both in India and England, got their extraordinary delusion regarding the pitiable state of agriculture which they imagine to prevail from one end of the great peninsula to the other? But on having recourse to books, the oldest and greatest enemies of India since we had anything to do with it, I soon succeeded in tracking the delusion to its source, or at least to one of its numerous sources. And, in tracing the stream backwards, how often have I been reminded of the quotation at the head of my final chapter—how often that "it is much easier to collect ideas of men and things from books than from real life, and that it is inconceivable how ideas once adopted continue to be propagated!"

On turning to the pages of the "British Encyclopædia," I find it there stated that agriculture is carried on in India in a rude and slovenly fashion, and that so careless are the people, that a field, after numerous ploughings, has many small bushes as upright as before the labour was commenced. Going back again some time further, we find a very miserable account in Mill, and there we find our bushes again; and going back still further to Buchanan, who travelled through Mysore after the war which terminated with the death of Tippoo, we find the original observer of the bushes in question, who had been deputed by Government to make a report on the products and resources of the Mysore province. And we also find that he talks of the ploughings, harrowings, &c., as expressions which he is obliged to use, but which will convey anything but the truth, as the operations usually understood by these terms could hardly be said to have been performed at all; and then

we have the statement of the bushes. As to what these bushes seen by Buchanan really were, I was rather at a loss to conjecture at first, but I have little doubt they consisted of a kind of leguminous plant which is sown along with the other grain, and, after the grain crop has been harvested and the land replanted, is left to ripen in turn. This plant (the name of which I have forgotten), being left at intervals, would certainly convey the idea of a bush left by chance or carelessness, and I have little doubt it was what Buchanan really saw. In any case, I am sure it could not have been a wild bush that he saw, as no fields that are cultivated with the usual seven or eight ploughings could possibly have such a thing left in them. To this statement of Buchanan, written about seventy years ago, I attribute a good deal of the notions at present prevailing; and it is just possible that Tennent, who talks of scratching as the only term to be used for Hindoo ploughing, and Orme, who alleges that "the Hindoo plough leaves scarce the impression of a furrow," have perhaps had something to do with these notions, which have been copied from one book into another down to the present time.

But if the ideas as to the wretched way in which the soil is worked are erroneous, far more erroneous are the ideas prevailing as to the way in which manure is squandered and destroyed. The laments on this head have been loud and numerous, and the members of the Cotton Supply Association have much concerned themselves regarding the neglect of this important part of husbandry. But of all the blunders of the Hindoos, the burning of cattle manure for fuel has long excited the deepest concern, and we accordingly find that, when a deputation from the Association waited on the Duke of Argyll, the

first thing his Grace thought of was to lament that cow-dung should be so used. But the importance of this using up of manure for firing purposes has been gone into at some length in a book entitled, "Notes on the North-west Provinces, by a District Officer," and I leave his words to express the common notions on the subject.

"But," says the District Officer, "if all the barren land were redeemed, the increase to the productive capacity of the country would be small in comparison to what it might be were the means devised of saving the farmyard manure. Nothing, I believe, tends to keep the agricultural classes so poor as the want of fuel, which compels them to use the dung for that purpose. The cow-dung is all carefully saved for this end. It is the chief occupation of the Indian peasant housewife, after she has drawn the water and kneaded the dough, to make the cow-dung into pats, and spread it to dry in the sun. It is then, if not wanted for immediate use, stacked and coated with mud, to preserve it from wet. Tons of it are every day brought into the large towns for sale, and it forms the only fuel used by the large mass of the population. In the cold weather, when a fire at night and in the early morning is a want, every available bit of horse, sheep, or goat's dung is greedily gathered and burnt. The women of the village may be seen scattered over the grazing plains, gathering in baskets every scrap of precious ordure they can find." "Nothing," he continues further on, "but the wonderful fertility of the soil, which seems to need water alone as a manure, saves the agricultural classes from utter ruin under such a system. But that it leads to the impoverishment of them, and of the whole country with them, is, I

believe, as certain as it is that a good dose of farmyard manure will more than double the crop."

Now, all this sounds very conclusive, but the whole thing is a delusion from one end to the other, and, so far from the burning of cow-dung being a loss to the country, it is the cause of a great deal of manure being added to the soil that would otherwise be wholly lost in roads and lanes, and on the barren plains. I well knew the value of this dung of lean cattle from my attention having been much drawn to the subject with reference to the manuring of our coffee plantations, but I thought it worth while to obtain the opinion of a well-known chemist, Dr. A. Dupré, as to whether there would be any loss in burning the dung of lean cattle as long as the ashes were returned to the soil, and that gentleman was of opinion that there would be hardly any loss at all.* Now, all the ashes in an Indian house are thrown on to the common manure heap, and so find their way to the fields; and added to these ashes of the dung dropped at home, are the ashes of every morsel of dung dropped in places where it would be entirely lost were it not for the use of cow-dung as fuel. And even if we assume for one moment that there is a slight loss from burning cow-dung, this is more than compensated for by the fact of manure being collected, which it would never pay to collect were it not to be used as fuel. I have no doubt that farmers who from a distance send their cow-dung for fuel to the large towns are losers by the transaction, but the general interests of the country do not suffer, as the ashes are applied to lands near the town; and we

* I may remind the reader that 1,000 lbs. of dung of grass-fed cattle in England contain only 4 lbs. of nitrogen, 3 lbs. of phosphoric acid, and 4 lbs. of lime, and that the dung of the lean kine of India must be much poorer.

accordingly read in Buchanan's work, written seventy years ago, that "farmers near the town of Seringapatam send bullocks to the town for all the refuse and sweepings, and besides collect numerous leaves to add to the manure heaps." It is really a sad thing to have to deprive Indian reformers, and the members of the Cotton Association in particular, of their cattle-dung laments; but unless some new and hitherto undiscovered qualities can be found in the manure of lean cattle, I am afraid they must be content to believe, for the future, that India loses nothing by manure being used as fuel. The base of the whole of these delusions I imagine to lie probably in the fact that the people here and in India argue from the dung of stall-fed oxen, instead of from the dung of lean, grass-fed cattle.

I shall again have occasion to return to the subject of manure; but I may observe here that natives are particularly careful to utilise all the manure they can lay their hands on, and it was noticed by Buchanan that a great deal of attention was paid to manuring the soil; and he also notices the custom, which seems to have always prevailed in India, of paying the flock-masters a certain sum per night on condition of their folding their sheep on the fields.

Having thus endeavoured to disperse a few delusions existing as regards Indian agriculture, I shall now proceed to enumerate and describe the implements used in the cultivation of dry crops in Mysore; and by dry crops I mean those which depend entirely on the rains, just as crops do in England.

As for the plough, it certainly does not need much description; and were you to cut off the head of a lean, long-snouted pig, add an iron continuation to the nose,

fix a stick into the back of the head, with a handle at the top for the plough-stilt, and another stick (pointed, of course, in the opposite direction) with a cross-bar at the top to lay over the necks of the pair of bullocks in front, you would have a fair idea of an Indian plough. As it may be imagined, this plough is not very expensive, and when I cultivated some rice-fields, a good many years ago, mine cost exactly ninepence. But rude as it is, this plough answers extremely well, and where labour is as cheap as it is in India, it would not pay to supply a much more expensive substitute; and it must further be considered that the draught power available is extremely weak, and that anything very weighty would therefore be unsuitable. The Indian plough, it is true, makes but a small impression at the first ploughing; but the native cultivator gets down as far as he can, and when he gets more rain he sets to work again, and gets down deeper; and all good cultivators plough their land seven or eight times in the year, and by this method attain at last a respectable depth. I sent one of my managers, not long ago, to ascertain carefully the depth to which dry lands are ploughed, and he reports that the common depth is about $4\frac{1}{2}$ in., or nearly the same depth reached when lea land is ploughed up in this country. The field is, of course, ploughed across and across, and in different directions, so that the soil is most thoroughly opened up and exposed to the action of the air, and by the time the seed-bed is fully ready, it would be difficult to find soil in a finer state of preparation.

The next implement I have to notice is the drilling machine, which seems to me to be superior to those in use in other parts of India, and, as will be shown, is

superior in many respects to anything we have in England. This machine sows twelve drills at a time of raggee, and a thirteenth drill of a leguminous plant, one drill of which is put down to every six drills of the grain crop. It is not generally an easy matter to describe a machine, but the one under consideration can be easily imagined, when I tell the reader to take twelve hollow sticks, about 4½ ft. long, run the ends through a block of wood pierced with holes at the requisite distances, and join the other ends into a central bowl. To this transverse block of wood, through which the sticks are run, is attached the ordinary plough-yoke, and, guided by the ordinary plough-stilt, the machine is driven along. The seed is then fed into the bowl, and through the sticks finds its way into the soil. The ends of the sticks are cut off at rather a sharp angle, so that the soil is gently raised, and then falls back on to the seed. This machine certainly does its work admirably, and it would be impossible to arrive at a better and more regular result than is thus attained by the Mysore farmer. When I have seen the machine used, one man guided it while another fed in the grain; but a very slight improvement, it is obvious, would enable the whole operation to be done by a single man. And here I may observe that when I come to compare the barbarous machines often used in the south of England with this cheap, simple, and effective machine, I am more surprised than ever at the utter ignorance of the English in India as regards the operations they daily see going on around them. Last spring I was in Wiltshire, the Salisbury plains of which county remind one so exactly of many parts of the interior of the Mysore table-land; and I found that the drilling machine in use there took

no less than four strong cart-horses to pull it, and no less than three men to manage it, and with all this the result was only fifteen drills sown at a time. And when I came further to witness the waste of draught power by harnessing three horses one in front of the other in the waggons, I could not help coming to the conclusion that, instead of sending out agricultural machines and lessons in the economy of power to the plains of Mysore, it would have been much more to the purpose to send some good Indian farmers to the plains of Salisbury, with the view of teaching the natives of these parts how to put down their crops more cheaply than they do at present.

The reader will remember that the use of drilling machines at all has only come into universal operation in England in, comparatively speaking, very recent times, and that the most important improvements in agriculture can date no further back than 1838. Now, I have always been at a loss to account for the early discovery of the drilling machine in India, and the only way I can account for its discovery there, while it was unknown in England, is that there are hollow sticks in the first country, while there are none in the second. India had everywhere the hollow bamboo, and the presence of ready-made tubes must naturally have suggested the machine, or at least have rendered its manufacture easy, cheap, and simple. But in England the only hollow stick at hand is the alder, and it is not of sufficient length to answer the purpose. Metal tubes were therefore a necessity, and as these required cheap manufacturing power, and would necessarily be costly, it is not to be wondered at that the drill was slow in coming into use. To this simple fact, then, of there being hollow

sticks in India and none in England may be traced, it seems to me, the economical husbandry of the former, and the enormous waste of food that has been occasioned in the latter country by the want of one of the most essential machines used in cultivating the ground.

The next implement I have to notice is the bullock drill-hoe used by the farmers in Mysore; and here, again, we have the same cheap and simple yoke, with the ordinary plough-stilt; but, instead of what we may call the ploughshare, there is a transverse block of wood, into which are fixed two iron blades. These blades pass between the drills, and, when the crop is a few inches high, weeds are thus removed, and the whole soil gently stirred and loosened.

The remaining implements in use call for no very detailed notice. After ploughing, a round log of wood is dragged over the ground, partly to level it, and partly to act as a clod-crusher. Following this we have a large bullock hoe, to throw weeds and roots to the surface, and this also tends further to pulverise the soil. Then there is a large wooden rake (drawn by bullocks), with twelve teeth, to remove weeds and roots, and a brush-harrow, which is used last before the ground is sown.

From the short description thus given the reader must have already come to the conclusion that, as regards a careful and cleanly drill husbandry, the natives have little to learn from us; and I may here mention that my late manager (the gentleman alluded to previously as being an experienced Scotch farmer), with reference to native agriculture, said, "When I came here first I thought I could improve the methods of agriculture as practised by the Hindoos, but I now find that, considering the means available, I can suggest no improvement

at all, unless, perhaps, the introduction of an improved plough." And I may add that some very able and experienced civilians, with whom I have conversed on the subject, are entirely of the same opinion. One of the gentlemen alluded to, after a twenty-five years' service as a collector and magistrate in the Bombay presidency, has now settled in England, and as he has taken to farming in this country, and paid necessarily a good deal of attention to the subject, it is satisfactory to find that his opinion confirms that of my late manager. And Campbell, in his "History of India," points to the proofs of the agriculture of the Hindoos as evident from the excellence of the crops. He then very pertinently adds, "To appreciate the skill of the natives a man must try a little cultivation on his own account, and see whether he can make it pay, or in any way succeed as well." "I," he continues, "have tried it, and seen a good deal of experiment." And the late Sir Mark Cubbon, in reply to some communication on this subject addressed to him by Government, contented himself with observing that, "as regards the careful cultivation of their crops, the natives of Mysore have little to learn."

Considering the actual facts of the case, it is amusing to read of the *furore* that has set in, the zeal that has been displayed, and the money that has been and is now being spent in teaching the Hindoos how to cultivate their fields. The results, too, of our agricultural efforts and exhibitions are often sufficiently amusing. Some years ago there was one held near Bangalore, when the natives, amongst other things, were to be shown how to cut their corn more quickly than they do at present; and, in order to make the advantages of our system more apparent and convincing, twenty women with reaping-

hooks were set to compete with scythes, and the result was that the women beat the scythes quite out of time. Sir William Denison, too, thought he would teach the natives how to thresh their rice-straw. Well, he got out the machine, and the natives beat the machine again; the fact being that the rice-plant is, when dry, extremely brittle, and a few knocks of a sheaf detach the grain. But the whole subject has been most amusingly shown up by Mr. Prichard, in his "Chronicles of Budgepore," and it seems pretty clear that these exhibitions have hitherto been merely a delusion from one end to the other. You read of them, or rather of each one, "being in every way a great success," and so they are a great success in the way of laying out money without any adequate return. An agricultural exhibition held at Calcutta is alluded to by Mr. Prichard, and we are informed that the country gained a total loss of £4,000 thereby, and that no one was a bit the better. The fact is that these things are quite beyond the intelligence and needs of the country, and, from the ignorance of the "promoters," are more likely to afford food for laughter than anything else. And then, as regards their aim and object, there is the invariable difficulty we are always met with in India—the want of means for disseminating information amongst the rural classes. I do not mean to say that the principle of agricultural exhibitions is a bad one, but their introduction, to be of service, should not only be gradual, but they should be evenly distributed over the country, with reference to the requirements of each district separately. I have some more remarks to make on this last point, but think it more convenient to reserve them for the suggestions I shall have to offer presently regarding the steps that I

think should be taken with the view of improving the agriculture of the natives.

We have now taken stock of the agricultural implements used in the cultivation of dry crops in the interior of Mysore, and I purpose next to say a few words as to the crops grown.

Over the whole dry-grain region of Mysore the prevailing crop is raggee (*Eleusine corocana*). The grain has rather a short straw as a rule, and has a head of considerable size, composed of grain about as large as turnip seeds, and of a dull red colour. This grain is said by Dr. Forbes Watson to be of about the same nutritive value as rice; but, whatever may be the chemical value of the sample examined by that gentleman, it is practically found that two meals of raggee are equal to three of rice; at least, such is the conclusion of natives in our part of the country. I cannot help thinking that the result arrived at by Dr. Forbes Watson is probably due to the fact of the samples examined having been grown in a wet climate, and in a poor soil; and, with the view of ascertaining the value of this grain, I have written to India for samples grown in the wet countries, and samples grown in the dry, open plain, and in the best land. These samples will be submitted to Dr. Forbes Watson, and should the result prove that this grain is not superior to rice, it will then be interesting to inquire on what its undoubtedly superior nutritive value depends.* To return to the cultivation of this grain: I may observe that it is put down in drills after the land is duly prepared, and that to every six drills there is sown one drill of bullar (*Dolichos spicatus*), a plant of the leguminous order, and

* See Appendix B.

with a leaf and seed very like French beans, though the seed itself is considerably larger. The plant is of slow growth, and is kept down by the corn crop, just as clover is in this country by the barley or wheat crop to which it commonly succeeds. After the raggee crop is harvested the land between the drills of bullar is ploughed up, and in the course of a few weeks the leguminous plant, in a good season, almost completely covers the ground. This crop is harvested in due course, and the land left to rest till the following year, when the same rotation is repeated. In occasional years, and according to the quality of the land, other crops, as castor-oil and gram (used as food for horses), are substituted for the raggee and bullar crops; but, as I have before observed, the last are the prevailing crops grown in dry lands throughout the Mysore province. This rotation may seem to be extremely narrow, but, considering the climate and the circumstances of the country, it is difficult to see how it could be altered in any way. In this country the nearest approach to it is to be found in the system prevailing in the Salisbury plains. There you have two white, or grain crops, followed by clover, or vetches, to be eaten off by sheep, and the following year turnips are put down, and this completes the rotation. Now, the climate of Mysore entirely precludes the growth of a paying grass crop to be fed down by sheep, and a turnip crop is quite out of the question, so there is nothing left but to take a grain crop and a leguminous crop alternately; and considering that both these crops are grown and harvested in the same year, the result of two years in Mysore just comes up to four years' growth in the Salisbury plains; so that when we come to compare the results, the Mysore

farmer seems far from badly off as regards the yield obtained from the soil.

The next crop that demands our attention is rice, and by Heyne's Tracts I find that no less than twenty-one varieties exist in the province of Mysore. The finer varieties are in general less productive than the coarser, and require a much longer time to ripen. The finest kind I ever met with was a very small-grained rice with a black husk; but this variety is, I believe, extremely rare. Considerable efforts have been made by Government to introduce Carolina rice. The results have been found to vary considerably in the several districts, according to the degree of care and attention paid to the subject; but sufficient has been done to warrant the late Commissioner of Mysore in concluding that, under similar conditions, it is equal, if not superior, both in quality and yield, to the indigenous kind of rice. It is doubtful, however, continues the commissioner, whether the instinctive prejudices of the ryot to what is new and foreign will ever be overcome, so as to allow of the introduction of Carolina paddy more generally. Considering, however, that the commissioner has admitted that this rice has only a doubtful superiority over the indigenous kinds, it is not to be wondered at that the natives do not put themselves to the trouble and expense of procuring the seed. We here find that, in accordance with tradition, the indifference of the people to Carolina paddy is put down to "the instinctive prejudices of the ryot to what is new and foreign;" but, for my own part, I shrewdly suspect that the thing would not pay. I have never found the natives, or indeed any one else, slow in taking to a thing that would pay; and I have never, for instance, observed that any attempt has been

made to show how "the instinctive prejudices of the ryot to what is new and foreign" were overcome in the matter of a cultivation so entirely new and foreign as coffee once was. But in India we always find some novel principle of action ascribed to the character of the people, in order to account for their not taking to what we fancy they ought immediately to adopt.

The cultivation of rice needs little description. The ground is ploughed in the ordinary way. Sometimes the seed is drilled in as with raggee, but in many instances, and in the wet districts almost always, it is put down in a nursery, and transplanted by hand. But little manure is added to the soil, which is annually enriched by the muddy water, which of course leaves a rich deposit behind it, more especially where it has flowed from jungle soils. The use of an extra supply of manure is, in the case of rice cultivation, attended with considerable risk, as, if abundantly manured, the straw grows long and strong, and the crop is therefore extremely liable to be laid by the wind. Where water is available, two crops can always be taken in the year, but in my part of the country only one is taken, though two could often be raised. Tradition has it that the natives in my neighbourhood were forbidden to raise two crops, in consequence of having incurred the Divine displeasure; but a better reason is to be found in the fact that, in consequence of the second crop being ready for cutting just at the commencement of the rain, the harvesting of the grain is necessarily precarious, and the result seldom sufficient to repay the labour of the people and of the cattle employed in ploughing and preparing the ground.

Wheat is grown, but in small quantities, and of infe-

rior qualities; and I observe by the Returns that there are rather less than 9,000 acres devoted to it throughout the whole province. Several varieties of millets are also grown, but the proportion of this crop is extremely small. Oil-seeds also are grown to the extent of about 77,000 acres; sugar-cane to the extent of rather more than 77,000 acres; and tobacco is put down at rather more than 19,000 acres. Only 1,201 acres are put down to opium, and 20,111 to cotton. Fibres, I may add, are estimated at rather more than 7,000 acres; rice at 836,632; and raggee and other food grains at 2,198,476 acres.

The live-stock belonging to the Mysore farmer consists, in the wet districts of the western part of the province, entirely of cattle and buffaloes, but in many parts of the open country farmers keep considerable numbers of sheep and goats. The ordinary method of improving breeds, though very insufficiently attended to, seems to have been long practised by the people of Mysore, and we accordingly read in Buchanan (vol. ii. p. 8) that farmers send their cows to be kept with herds of the larger and superior breeds. The male calves produced were sent home to the farmer, but the female calves were left with the herd to be again crossed with the superior breeds, and the same process repeated. In this way the breed was entirely altered for the better in the third generation. But, as I have said before, breeding is very insufficiently attended to, and though, by the castration of inferior and the preservation of superior bulls, a certain amount of good is done, it may be said that the want of attention to breeding of good stock is one of the greatest defects in Indian husbandry. It is evident, however, that a certain amount of atten-

tion must be steadily directed to maintaining the breed of the large, well-bred cart and carriage cattle which are so frequently to be met with. This breed is entirely different from the common village breeds, used for ploughing and ordinary agricultural purposes, and would soon be lost if pains were not taken for its preservation. But in this instance it is much easier to point to the evil than to suggest a practical remedy. In England, from the country being divided into fields, the separation and improvement of breeds are easily and certainly carried out. But in India there are neither fields nor fences, and the cattle belonging to the farmers of a village are massed together and driven to a common grazing ground, where they not unfrequently mix with the herd of some neighbouring village. Under these circumstances the difficulties of improving a breed must obviously be considerable; in fact, so considerable that they may almost be held to be insurmountable. And here I conceive that a very little aid on the part of the Government would be of material advantage; but I shall reserve what I have to suggest on this subject for the concluding remarks of this chapter.

As regards sheep I have really no very reliable information to lay before the reader, excepting that the Government a good many years ago procured merino rams from Australia, with the view of introducing a superior breed into the Mysore country. But the project—from what causes I am ignorant—seems to have met with no success, and has been entirely given up. The wool of the native sheep is coarse and hairy, but seems to be very well adapted for the manufacture of the ordinary blankets used by the natives.

Having thus briefly glanced at the most prominent features of the agriculture of Mysore, it is time now to consider what can be done by the Government towards effecting improvements on the state of things as at present existing. And here I conceive the first thing to be done is to dismiss entirely the idea of, for the present, introducing any new machines for the economising of labour, as reaping or threshing machines. Where labour is very cheap, machines seldom pay, unless, for instance, in the case of an absolutely indispensable machine like the drilling machine; and it may interest the reader to learn that in the west of Ireland, and only a very few years ago, the reaping machine, in the hands of an experienced Scotch farmer, paid only infinitesimally better than hand-cutting. The farmer who tried the experiment, I may add, told me that by using reaping machines he calculated he had only saved £1 on the whole reaping of a considerable farm. Machines, too, for grinding corn are also of very little value where the women of the farmer's house have little better to do. Indeed, the only machine that I can think of that would be of any real importance is a machine for detaching the husk from rice that is being prepared for market; and even here it is seldom, I conceive, that water power could be procured at the season it is most required. I see no reason, however, why some cheap kind of windmill power should not be started, as winds blow very regularly in the Mysore country; and if a machine of this kind could be put up for a small sum, I see no reason why it should not come gradually into use. I merely, it must be remembered, throw this out as the only hint that I can conceive to be of any possible value, and it would still remain to be seen whether,

having regard to the present low rate of wages, any kind of labour-saving machine would pay.

The next thing to dismiss from the mind is the idea that any good is as yet to be effected by holding large agricultural exhibitions at a given central point in the province. In fact, to commence your efforts at agricultural improvements by having recourse to such a childish process, is exactly the same thing as if you were to commence your educational efforts by building an enormous college at Bangalore, without establishing a single school in the districts. And just as you must have schools to feed your colleges, so must you have numerous local agricultural schools to start with; and your great agricultural exhibitions should be held at the end of a considerable period of evenly-distributed agricultural education. Having thus carried out the process that most writers on Indian subjects must do, namely, that of pointing out what should not be done, it now remains to indicate those measures which I believe would be of solid and lasting benefit to the country.

The first object, then, of Government should be to improve the breeds of cattle; the second, to improve the breeds of sheep; the third, the discovery of new manures, and the introduction of means for increasing the supplies of manures already in use; and, fourthly, it would be desirable to devote a piece of ground to the propagation of any new plants that might be of general use in the country, and especially medicinal plants, as also various kinds of fruit trees, and plants useful for their fibres.

To prosecute these objects thoroughly, I am persuaded that it would be absolutely necessary to have a small farm in each county, a large farm at the head-quarters

of each division or circle of counties, and a still larger farm than any of these at the capital of the province. Little, of course, need be said as to the way the central farms at the head-quarters of the districts should be conducted, as it is evident that they must act, in the first instance, as feeders and centres of supply to the county farms. But the management of the county farms requires a few remarks as to the way in which they should be worked, in order to be of real benefit to every member of the community.

In the chapter on Education it has been pointed out that the only way to produce any impression on the people is to arouse their attention from a practical point of view, and to develop an interest in every sort of thing that may add to their comfort and increase their prosperity; and it seems sufficiently obvious that a farmer's son will be none the better for being crammed at the county school, if his so-called education is to commence and end with books. A certain set, or sets, of ideas will have been temporarily drilled into his memory, and even out of that they will soon leak when he has retired to ruminate in his ancestral village. To effect anything, the farmer's son must be sent home with something a great deal more solid—something that every day will remind the father of the advantages to be derived from sending his son to school. Now, the only way I know of arriving at this end is to attach to the county school a county farm, and to make the education of the farmer's son an agricultural one; and when the boys go home for their holidays, they will thus carry something of general interest along with them. When asked what they have learnt, they need no longer enlighten the parental mind as to how far the village is

from the Himalayas, as to what European power first possessed Bombay, or as to the immense advantages of living under an enlightened and eminently law-devising Government. They will be able to tell of facts a good deal more interesting. And some interest will be aroused when the village lad has to tell of cattle of superior breed, of sheep of larger build and finer wool, and of plants which, unaided by the village magician, will drive away fever and dysentery. And when the lad grows up and retires to his village, you may depend upon it that he will not be contented with the things that satisfied his forefathers; nor will he rest satisfied till he has improved his stock, and filled his garden with every plant of practical interest. But I need not say more as to the advantages to be derived from the suggestions I have to make, and it will be more to the purpose if I describe, as briefly as possible, the system I would like to see carried out as regards the county farms.

The head of the county school, then, should be a man entirely fitted to be the head of the county farm, and the school should, if possible, be in the very centre of the farm. The farm itself should be entirely worked by the boys of the school; and though, at present, boys of Brahmin caste might be exempted from work, I feel persuaded that with the march of the age the Brahmins even will advance, and see nothing derogatory in work that their ancestors would have thought to be degrading. And by employing, for certain hours of the day, such of the boys as seem strong enough to work, the farm might easily be made to be self-supporting. Enough grain could easily be grown to feed the stock, and the annual sale of bulls and rams would readily pay for any extra labour that might be required. The sale also of useful

plants and improved kinds of corn seeds would add not a little to the result, and I have little doubt that under judicious management the farm might easily be made to pay its expenses. And it is here that I would recommend the introduction of agricultural exhibitions. Once a year I would have an examination, and give prizes to such of the scholars as had most distinguished themselves in the various branches of the educational system; and at the same time an exhibition might be held on the farm, which I feel sure would interest all the country round. Nor would I despise those attractions which by the solid Britisher are often, or I should say nearly always, neglected, and a few rupees laid out in sky-rockets and fireworks in general might terminate the day. This exhibition system might be gradually extended so as to include two or three counties, but a general exhibition for, say, a whole province is not, I think, a thing that should ever be attempted, at least in our generation.

I shall now conclude this chapter with a few remarks on those points which I think are of especial value to the people.

The improvement of the native breeds of cattle and sheep is, of course, the point which first of all claims attention;* and, in a country where the whole draught power available for agriculture consists of bullocks, it seems sufficiently obvious that to strengthen the breed would enable the farmer to plough deeper than he does at present without any additional expense, and that consideration alone is an ample one for paying the greatest attention to the subject. I need not, therefore, trouble the reader with further remarks as to the many

* See Appendix C.

other advantages a superior breed of cattle would confer on the people; nor need I weary him with details and suggestions for carrying out this scheme of stock improvement, as, if the principle of the proposed system is admitted to be sound, the rest would be easy. On the advantages, too, of improving the breed of sheep little need be said; but when we turn to the subject of manures we shall find rather more to say.

It has been pointed out, in a previous part of this chapter, that the Indians are very careful to utilise all the manure they can lay their hands on. There is, however, one exception to this—not, it is true, a very important one, considering the circumstances, but still worthy of a passing notice: I mean the use of bones as a manure, or rather the absence of this manure from the list of fertilising substances. In fact, the value of bones never seems, that I know of, to have been discovered by the natives; and I am led to think that this is partly owing, if not entirely, to the fact that bones are difficult of collection, and in a non-meat-eating country can never be supplied in sufficient quantities and at a low enough rate to prove remunerative. To tell the natives to use what bones can be found would be, therefore, of little practical value; and as it is evidently a most important matter to supply the people with phosphate of lime in some shape or other, I think that the Government in India should make every endeavour to discover the mineral phosphate of lime which exists in coprolites and in apatite. From inquiries I have made, I have no reason to know that the mineral phosphate has been discovered in India, with the exception of a discovery of fossil bone which a gentleman of experience told me had been made in the Punjaub. I

have little doubt, however, that this important manure will sooner or later be discovered, and it may be useful here to give a simple and ready test by which the presence of the phosphate of lime may be discovered.

To a portion of the substance add a small quantity of muriatic acid: heat slightly, and add ammonia. If the addition of ammonia is followed by a milk-white precipitate, this shows the presence of the phosphate of lime.

Now, if the means of applying this simple test were placed in the hands of all the principal district officials and engineers in India, and a small reward offered for the discovery of an available bed of the mineral phosphate, we should soon, I imagine, arrive at a satisfactory result, and thereby effect the greatest possible improvement in the fertilising resources of India.

The only other sort of manure that could be at all increased by the action of Government is leaf manure. In the chapter on Coffee the value of leaves as a manure is pointed out at some length, and it is shown, on the authority of Mr. MacDonald, that the leaves of many trees are particularly valuable. The natives of India seem long to have been aware of this, and, as Buchanan observed more than seventy years ago, large quantities are collected to add to the manure heaps. The value of the particular kinds of leaves is well known in my part of the country, and they are collected in considerable quantities, to be broken down by cattle in the sheds, and also to be used alone. In a country full of jungle, any quantity of leaves can, of course, be easily collected; but in the populous plains, where trees are few and far between, this manure, of course, is rarely to be had, and with the

view of increasing the supplies of this (under the circumstances) important manure, I would gladly see the Government establish a large plantation of the best kinds of trees on the waste land, or rather the uncultivated land of every village. And I would compel the inhabitants of every village to supply the whole labour for the formation of the plantation, and make the farmers of the village entirely responsible for its permanent maintenance. To our ideas this might seem, to say the least of it, rather an arbitrary way of going to work, and were the supply of leaves the only object to be gained by the measure, it might certainly seem to be hardly justifiable. But there are many other objects I have in view besides, and amongst the least of these may be mentioned supplies of firewood, and of wood for building and agricultural purposes. The greatest object, however, that I have in view, and an object that must readily occur to most people, is to modify climate, and to increase, or at least to economise, the rainfall. I have no intention here of going into the vexed question as to whether forests do or do not indirectly cause more rain to fall than otherwise would, and for my present purpose it is quite sufficient to point to this very obvious fact, namely, that air passing over a barren plain becomes very soon hot and arid, while air passing over a country studded with trees and patches of forest is naturally moist, and, comparatively speaking, cool. If these facts be assumed as altogether incontrovertible, it is evident that the climate of an elevated table-land like that of Mysore could be modified to an extraordinary extent if it was studded with plantations, instead of being so entirely open as it is at present; and I need not expatiate on the difference, as far as vegetation is

concerned, between an arid parching wind and a moist cool breeze. The Government of Mysore has for some years been endeavouring to induce the people to form plantations by the offer of land on the most liberal terms; but from want of information, and partly, perhaps, from the feeling of insecurity brought about by the numerous changes of one kind and another that have been effected, nothing whatever has been done towards carrying out this important project. And here we have a very good illustration of the peculiar vice of our Government in India. We find our rulers in India timid where they should be bold and imperious, and we find them bold and incautious where they should act with the most careful circumspection. We find our rulers incredibly rash in promulgating measures which are entirely distasteful to the people, and which tend to a serious unpopularity, and we find them, on the other hand, shrinking from the arbitrary exercise of power in a matter which, when once carried out, would carry to every native mind a greater idea of our wisdom and forethought than anything we could possibly do in India. Forgetting that "a' law's no justice," we force our laws down their throats by the ton. If we forced trees down their throats by the acre, it would be much more to the purpose. But there is no use in saying more, for few know what should and should not be done in India, and nobody cares.*

* Since writing the above I have met with some very valuable remarks on this subject in Dr. Bird's "Physiological Essays," which I cannot resist quoting at length. "Trees," says Dr. Bird, "render the atmosphere more uniformly moist. They do so partly by extracting moisture from the winds as they pass by, and partly by hindering the sun and winds from taking away that which they already possess. By means of the cool, which is the result of the evaporation from the multiplied surface of the foliage, they temper the hotter winds which are passing over them, and so induce them to part with a portion of their wet. . . . By rendering the atmosphere more uniformly moist, they temper the

I have said that at each county farm a small plot should be set apart for the cultivation of useful plants and trees, and especially of those useful for their medicinal qualities. At the head of these, of course, stands the cinchona, but there are many other medicinal plants and shrubs, the value of which should be taught in the village school. To any one who has lived as I have amongst the people, it is melancholy to see young children wasted with fever and ague, which a few grains of quinine might have arrested if applied in time, and to see people suffering on from various complaints which, as I have found by experience, readily yield to simple remedies. And, leaving all con-

heat and cold of the different seasons. Trees also cause the rainfall to be distributed more equally in time throughout the year. They bring down the atmospheric moisture in more frequent and gentle showers; whereas, in a country denuded of wood, this goes on increasing, until, from electrical and other causes, it is precipitated in floods, to the accompaniment of winds and lightning. These floods, joining together, rush down the slopes, and inundating the plains, pour themselves into the sea. This is what happens in the South of France now, as in recent times most of the Northern Pyrenees have been stripped of trees. Trees again, by inducing frequent and prolonged gentle showers, economise the water of a country, and so make it more available for existing vegetation, and for its future extension. They also, by chemical action and by friction against each other and the winds, add to the atmospheric electricity, and they modify sunlight. They rob it of most of its chemical, and many of its coloured rays, and then reflect it, thus softened, upon surrounding objects. . . . . They, by absorbing and radiating heat, modify it and give it new properties, in virtue of which it acts differently on us from what it does when it falls directly on us from the sun. Trees again, by their chemical action on the air, and on the ground in which they grow, prepare a soil for plants which require a richer food, but which are more useful to man in his daily life." Finally, Dr. Bird has discovered another important fact, viz., "that villages out in the open plain suffer far more from cholera, and the disease is more deadly there than in villages which are well wooded." This certainly is an interesting fact, and has, I believe, been universally confirmed in India. But, as regards my own part of the country, there are several differences in the circumstances which ought to be taken into consideration. The first is the fact of the people being more cleanly in their habits (so much is this the case that our local coolies will not use the same lines as the open or plain country labourers); the second is that the houses are more scattered; and the third is that in jungly countries there are few travellers. On my property (started fourteen years ago) there has never been but one case of cholera, and that occurred amongst a party of labourers who had fled from a village in the plains where cholera had broken out; and in one village contiguous to my property the oldest inhabitant never heard of a case.

siderations of humanity entirely on one side, I feel persuaded that Government would be amply rewarded for any expenses incurred on account of medicinal education; for the health of the population would be improved and conserved, and the number of the people would certainly be increased. Now, more Hindoos will cultivate more land, and therefore pay more taxes, and I have always thought it one of the most singular oversights that this important fact should have been so entirely lost sight of by our revenue authorities. They seem to have thought of filling their coffers in all manner of ways, but they never seem to have thought of filling them by the simple process of breeding plenty of Indians. It seems, however, that our Indian rulers have at least advanced so far as to have discovered that it does not pay to let people die by the million as they did in Orissa; and having got so far, it is just within the bounds of hope that they may one day see the advantages of taking every measure to increase the number, and to conserve the health of the population. It might, at first sight, seem that these objects might be more readily effected by the establishment of hospitals; but, independently of considerations of expense, there are many other obvious objections to depending upon establishments of that sort, which I need not waste time in enumerating; whereas a few hours a week might easily be set apart in the county school for instruction as regards the ways of using and growing the most useful medicinal plants, and, as the growing of these plants would be personally managed by the boys, the carrying out of this scheme would be at once cheap and effectual.

It is time now to draw this chapter to a conclusion, but, before doing so, it may be as well to take a back-

ward glance, and recapitulate as briefly as possible at least a portion of the ground we have traversed.

In considering, then, Indian agriculture in general, we first of all glanced at some of the delusions at present existing concerning it, and endeavoured to trace at least some of them to their source. We then took particular notice of the delusions existing regarding the use of cattle-dung for fuel, and reasons were given to show that, so far from this practice being of any detriment to the country, it was the cause of a great deal of manure being added to the soil that would otherwise be entirely lost. And it was then pointed out that the natives were particularly careful to utilise all the manure procurable, and that they were even in the habit of paying the flock-masters to induce them to fold sheep on the arable lands. Turning next to the tillage operations, we saw that the depth of ploughing on dry lands was about $4\frac{1}{2}$ in., or nearly the same depth attained in this country where grass or lea land is ploughed up; and it was pointed out that the soil, in consequence of the frequency of the ploughings, was always reduced to a very fine state of comminution. The Mysore drilling machine was next compared with that in use in the Salisbury plains, and the former was shown to be much cheaper in every possible way; and it was also pointed out that, as regards a cleanly and careful drill husbandry, the farmers of Mysore have little to learn from us. We next remarked on the rotation of crops in the Mysore country, and saw reason to conclude that though the rotation is a narrow one, it is impossible, on account of the climate, to alter it. We then glanced at the attention paid by Indians to the breeding of cattle and sheep, and though it was shown that the natives are aware of the importance of

improving their stock, saw reason to think that this branch of industry had been much neglected. In commencing to consider what can be done towards improving the general state of husbandry in all its branches, we came to the conclusion that, where labour is as low as it is in India, machines for the economisation of labour could never pay; and it was also pointed out that no good could be done by holding at intervals large agricultural exhibitions. An opinion was next expressed as to the advisability of keeping a farm at the headquarters of each county. It was suggested, further, that the county school should be in the middle of the farm, and that the head of the school should superintend, or at least have charge of, the agricultural and breeding operations; and it was shown that, by making use of the boys in working the farm, and by selling off annually a portion of the stock, the farm itself might be made self-supporting. It was also suggested that at each county farm an exhibition should be held annually, and that in the course of time exhibitions might be held so as to include several counties. The importance of discovering the mineral phosphate of lime was next remarked on, and it was suggested that the only other way of adding to the manurial resources of the country would be by forming plantations of trees whose leaves were valuable for manure. The general advantages of plantations to the people as regards improving the climate were also pointed to, and it was recommended that the people of every village should be forced to plant trees in the vicinity of the village. And, finally, it was pointed out that by forming a garden full of the most useful medicinal plants, and by instructing the boys of each county school how to cultivate them, a large amount

of good might be effected by thus placing in the hands of every class of the people cheap and simple remedies for the prevailing diseases from which they suffer.

One word more. If the Government resolves on doing anything towards improving the general agricultural knowledge of the country, it should always be borne in mind that no good will be effected by commencing at the top. In everything we see this fatal tendency, and in no way more conspicuously has it been shown than in the attempts at educating the people. What we must have in everything is a wide base, and we should be content to wait many years for the crowning-point of the edifice. Hitherto we have been merely acting like children. To raise the people of India we have commenced with English education, which is quite beyond their reach. To improve their agricultural knowledge we have commenced with large central exhibitions, which have been throughout a loss and a laughing-stock.*

* In Indian Administration Reports the most valuable information is, of course, entirely wanting. The Mysore Report for 1868-69 consists of no less than 376 pages, and yet there is not a single agricultural statistic of any practical value. We are told that "the drinking and cooking water of the prisoners is excellent and carefully filtered, that the bathing arrangements detailed in Section I. are now very complete, and that no change has been made in the prisoners' clothing during the past year;" and I suppose we shall some day be duly informed whenever a prisoner gets a pain in his stomach. The reader will find some remarks on agricultural production, and the particular value of statistics, in Appendix D.

CHAPTER X.

COFFEE-PLANTING.

I HAVE always maintained that the members of this nation have invariably been found to excel in whatever they seriously attempted. As an instance of the superiority that has, by the hereditary transmission of qualities, been invariably brought about, and as a proof that caste, by confining men to particular callings, has called into existence a superior proficiency, Elphinstone has alleged that the Indian hereditary thieves beat all the world. But notwithstanding all the stories that have been told, and all the feats that have been indisputably performed, I doubt if an experienced, high-class London burglar does not frequently display combinations and resources which are far beyond the reach of his Indian contemporaries. And just as I believe that the first-class London thieves beat all other thieves, so do I believe that the first-class London adulterator beats all other adulterators. And if other claims to an exalted proficiency in the art were wanting, I feel sure that his claims in the article of coffee alone would at once place him at the head of the whole civilised world. I said of the civilised world, because just as a kind of wild, irreclaimable savagedom is the natural inheritance of the Red Indian, so is adulteration the natural inheritance of

the English grocer; and it is extremely doubtful whether in future, instead of talking of civilised and uncivilised men, it will not one day answer the purpose equally well to speak of adulterators and non-adulterators. It is melancholy indeed to contemplate the straits to which the human animal is incessantly driven to, and the temptations which impel him to prey upon his species. We are apt to imagine that England is a great deal the better because illegal proceedings are seldom combined with force; but the force that was previously applied is not lost—it is merely transferred from the outside to the inside of the body. In ancient days it was your money or your life; now it is your money certainly, plus sand, and poisons, and dirt, to wear out your alimentary canal. The man is at your throat all the same. Centuries ago he was a lawless plunderer; now he is a lawless grocer. I doubt here if I am not rather too disinterested in talking against your lawless grocer; for I cannot help suspecting that the high price that all the Mysore coffee obtains is not a little owing to the fact that the strongest and finest flavours can pass off the most ground nuts or the most chicory. But, after all, I may comfort myself with the reflection that what I have to say will run off like water from a duck's back, and that, even if I did produce any impression, it would merely be the impression that the detectives produce on the thieves, and would result in a more skilful system of adulteration. In fact, adulterators, in the hot pursuit of the almighty dollar, are sure to win, and are always sure to be sufficiently ahead of the police. And if we want evidence in support of this, we have only to turn to that collected in a paper which appeared in the June 1870 number of *Fraser's Magazine*. There we are told

that, in his Report of 1867, Mr. Phillips observes that —"A duty which imposes considerable labour upon the laboratory is that of keeping pace with the ever-increasing ingenuity of those traders who resort to the sophistication of their dutiable commodities as a means of meeting the keen competition in trade, and who hope to escape detection by the use of new methods of adulteration. It occasionally happens," he adds, "that adulterants are employed which, from their fine state of comminution, or from other causes, baffle identification, both by myself and by my most experienced assistants for a considerable time. . . . . Not unfrequently samples have to be analysed by my assistants, to which the attention of chemists had not previously been directed; and the special researches consequent thereupon constitute an important part of the work of my department, and require often for a considerable time the closest attention of my assistants."

With reference to coffee we are told by Mr. Phillips that —"There is probably no article of general consumption on which a duty is levied, by means of which the purchasers are so imposed upon as by coffee when supplied in the ground state, the low-priced descriptions lately examined in the laboratory having been found to consist almost entirely of chicory. To neutralise the objectionable and earthy taste produced when chicory is extensively mixed with coffee, a practice has of late prevailed of adding to such low-priced mixtures caramel or burnt sugar, which, by its bitterness, serves to conceal the disagreeable flavour imparted by chicory."

Warned by the press, and by a long and bitter experience, the natives of these islands bethought themselves of buying the berry roasted, and grinding it at home.

Here, at least, we are safe, they thought, and it at first really seemed that they had stolen a march on the adulterators. But they did not long enjoy their triumph. To meet the new difficulty the aid of the mechanic had this time to be called in, and he soon produced a machine for the manufacturing of imitation coffee berries, and accordingly we read that—"It was likewise stated to the Select Committee by a witness who had seen the specification at the Enrolment Office, that Messrs. Duckworth, of Liverpool, took out a patent for certain improvements in the manufacture of chicory, and for compressing chicory into the form of berries or any other arbitrary forms. I had occasion, about the year 1851, to take a sample of these berries, and when mixed with coffee, although to any one acquainted with the nature of roasted coffee the difference might be observable, to the general public I do not think it would. They were in the form of coffee berries. I never saw them in any other form: whether they were compressed into other forms I am not aware."

The only thing now left to the coffee consumer is to buy the original raw berry itself; but people in England will not be at the trouble of roasting it, and often, if they did take to doing so, the adulterator might still steal a march on them by manufacturing imitation raw berries to mix with the real ones. I am not aware whether this has ever been attempted; but if it has not, it must have only been because the public do not buy raw coffee in sufficient quantities to make an imitation raw-berry manufactory pay.

From what has now been said, and from cheering proofs that have been given of the adulterative powers of

England, it is plain that, supposing I am correct in attributing at least some part of the high price paid for superior coffees to their power of passing off a greater quantity of adulterative matter, I cannot do much harm to my neighbours in Mysore by aiming a few more blows at coffee adulterations, and I accordingly proceed to offer one or two observations more before closing this important branch of coffee.

Some years ago a member of a large wholesale coffee-dealing firm was showing me some new machinery that had been invented by one of the firm for roasting coffee. While I was admiring the ingenuity of the arrangements, I saw a man wheeling out of the far corner of the building a large truck. "What is that?" I asked. "That," said my guide, "is chicory." "Chicory!" I observed; "that is the enemy of coffee." "Not at all," was the answer; "we consider chicory to be the friend of coffee." I said no more then; but I propose to ask now whether chicory is indeed the friend of coffee. Now, as far as I have been able to discover, chicory has immensely aided in lessening the consumption of coffee in this country, and it has done so from the fact of its being a substance decidedly injurious to the system, and from its being more especially injurious to all those who have not strong constitutions. The effects of chicory taken alone were clearly proved by Dr. Hassell to result in feelings of drowsiness, weight of the stomach, and great indisposition to exertion, and, in two instances, headache soon followed. Experiments conducted with coffee at 1*s.* 6*d.* per lb., but which was largely adulterated with chicory, did not produce such disagreeable results, but the effect showed itself by bringing on diarrhœa. But, from the injurious results

that ensued from chicory taken alone, it is plain that it does produce some very disagreeable results, and I therefore think that we may reasonably conclude that many of the people who, from its disagreeing with them, cannot drink coffee at present, are only unable to do so because this adulterative substance is generally present, and to the extent of from eighteen to twenty per cent.; and as for the low-priced coffees, as has been previously shown, they are almost wholly composed of chicory. The next point to be taken into consideration is, that chicory has only about half the nutritive value of coffee; and when we come to consider that chicory falls, as a food, to half the value of coffee, and that it produces many disagreeable and no agreeable effects, I need not waste more words in showing that chicory is certainly rather the enemy than the friend of coffee. I am aware, of course, that there are numerous reasons to be assigned for the falling off* in the consumption of coffee in this country; but when I find, on the high authority of M. Payen, that coffee is very nourishing, that it contains a large quantity of nitrogen, and three times as much nutriment as tea, it is difficult to conclude that, with these advantages, it would have lost so much ground as it has done, were it not for the difficulty experienced in getting it unmixed with chicory and other deleterious substances.

One word more as to adulteration, and I pass on to the pleasanter, if not the more interesting, subject of the growth of the berry.

"The original tendency," to use a Chinese maxim, "of man's heart is to do right; and if a due caution be observed, it will not of itself go wrong." The blame,

* The amount of coffee retained for home consumption amounted in 1847 to 37,441,373 lbs., while in the year 1867 we only retained 31,289,106 lbs.

then, lies with those who have the power of providing that "due caution" which seems so necessary to uprightness. But sufficient checks not having been imposed at first, the race of adulteration has set in with a vengeance; and the national character having acquired an adulterative bend, hard indeed is the task to get it straight again. But hard though the task may be, a serious effort should be made; for just look at the results of adulteration, as expressed in the Report of the committee, and which are quoted in the magazine I have previously borrowed from:—

"Not only," we are told, "is the public health exposed to danger, and pecuniary fraud committed on the whole community, but the public morality is tainted, and the high commercial character of this country seriously lowered both at home and in the eyes of foreign countries. Though happily very many refuse, under every temptation, to falsify the quality of their wares, there are, unfortunately, large numbers who, though reluctantly practising deception, yield to the pernicious contagion of example, or to the hard pressure of competition forced upon them by their less scrupulous neighbours."

But go where you will, and turn the conversation on whatever subject of trade or commerce, or buying and selling, you choose, and you will find that the violent rush now prevailing for money, and quick money, is such that nothing but the severest penal enactments can possibly check the evils that arise from the excessive competition now prevailing. Laws and regulations have been built all over the world on the supposition that man has been provided with a fair amount of unyielding honesty; but, whatever may have been the case in

former times, it is certain that now man yields with extraordinary facility to the smallest pull of the almighty-dollar string. There is no permanent alteration, of course, in man; but there is, it seems, a considerable alteration in the quantities of temptation he is subjected to, and to these altered conditions our laws should be adapted. And just as the sambur on the Neilgherry Hills has become more nocturnal in its habits in consequence of the pressure of circumstances, so has man become more rascally, partly from pressure, partly from temptation; so that all round the world you will find things that were formerly taken in good faith, as to weight and quality, have now to be rigidly tested. Some people still allege that our commercial honesty is better than can be found amongst the people of other countries; but there seems reason to think now that our old reputation has faded, and faded irretrievably. Some years ago a gentleman I happened to be travelling with told me that he had lately been asking an old native merchant at Calcutta what he thought of the English as a commercial people. "Well," said the old man, "for five-and-twenty years I dealt with the English, and always thought them the best people in the world to have anything to do with; but," he added, "since the company mania has set in, I have gone back to my own countrymen." But I must now finally quit this interminable and disagreeable subject, and address myself more particularly to the subject of this chapter.

The earliest notice I can find of coffee in India is contained in a Dutch work entitled, "Letters from Malabar," by Jacob Canter Visscher, chaplain at Cochin. This collection of letters has been translated by Major Drury, or rather at his instance, and as the date of the

Dutch editor's preface is 1743, I conclude that the coffee-plant must have been introduced at a somewhat earlier date; for, at page 160, we read that "the coffee shrub is planted in gardens for pleasure, and yields plenty of fruit, which attains a proper degree of ripeness. But it has not the refined taste of the Mocha coffee. An entire new plantation," we are also informed, "of coffee shrubs has been laid out in Ceylon." The plant, however, though introduced at this early period, does not seem to have met with much attention in India, and I can find no other allusions to coffee in Indian books till we come to Heyne's Tracts, which were published in 1800, and we are there merely told that coffee was sold in the bazaars of Bangalore and Seringapatam.

Turning now to the history of coffee in Mysore, we find that there is no official record of either plant or planting further back than the year 1822; but tradition seldom fails in some marvellous story, and we accordingly are told by Colonel Onslow that the plant was said to have been introduced by a Mussulman pilgrim, who brought seven berries from Arabia about two hundred years ago. These berries he planted round his mutt, on the Baba Booden hills of Mysore, near which some very old trees may still be seen. But though the plant seems to have been known from time immemorial, the berry has never come into use amongst the people who grow it; and when I first located myself in Munzerabad, about fifteen years ago, the farmers who grew coffee often asked me what we did with it, and I have repeatedly been asked whether we ate the berry, and of what use it could possibly be. Nor, though now aware of the use of it, have I ever heard of a native farmer

drinking coffee, except one man, whom I persuaded to try it, and he, after a few experiments, found that he was seized with violent dysenteric symptoms,* which were naturally brought on by his using his coffee too soon after it had been picked. The effect of using coffee (and especially native coffee, which is a mixture of green and ripe berries, and which is always fermented, in order that the skin may be more easily detached) that has not been kept for some time is generally to bring on diarrhœa, and I have no doubt that this common result, and the ignorance of the natives as to the necessity of keeping the berry, have probably produced a general conclusion that it is better to sell the coffee, and lay out the money in something which will produce a pleasanter effect on the system. But, however that may be, it is certain that the native farmers do not care about coffee as a beverage at all, and it is very doubtful if they will ever take to it.

Having thus briefly alluded to the use, or the ignorance of the use, of coffee as far as the natives are concerned, we may now say a few words more as to its history in Mysore, before proceeding to discuss planting in general. Some years, then, after the country had been

* I may here mention some conclusions as to the use of coffee amongst our troops which may be of use to our medical authorities in India, and which have been more particularly forced on my attention by the effect which will invariably be found to arise from using fresh native coffee. The coffee crop in India is picked, say, in December, and the new crop finds its way into the market a few months later Now, the great cholera and dysentery season amongst the troops in Bangalore is generally in April and May, and I have very little doubt that the coffee supplied to the troops is from the new native crop, as all the produce of the English planter is sent directly out of the country; and even were it not, it would still, I conceive, be partially liable to the same objection that new native coffee is. This may seem a trifling matter, but in a tropical climate, and in an unhealthy season, a very little may, and no doubt often does, turn the scale. And what I should propose for the future is that the Government should procure regular supplies of sound plantation coffee, and always have a year's consumption in advance.

handed over to British management, a few Europeans took up the cultivation of coffee in the north-western division of the province; but, for some reason or other, little progress seems to have been made. I fancy, however, that it was more the want of information than anything else that prevented an extension of planting, and partly, perhaps, the fact that Mysore was merely a native state under British supervision, which might be any day withdrawn. But, whatever the reason was, there was only one plantation proprietor on our side of the province when I entered it in 1855; and, at the original seat of coffee in the Nuggur division to the north, there were only three English European planters. Nor, for a good many years later, were their numbers materially increased. On one side of the country two other planters took up land at the same time as myself, but this only made a total of four, and I do not think this number received any addition for some five years more. These were glorious days in Munzerabad, when we enjoyed our hunting-grounds and our labour market in peace, and when twelve long miles separated each planter from his neighbour. But now, alas! all is changed: bears have become scarce, labour has become dear, seasons have become drier, it is impossible to ascend a mountain without the eye being offended by the glaring white walls of bungalows not more than four or five miles apart, and, in short, the county is hardly worth living in. But it is useless and unprofitable to waste time and paper on vain regrets, and if bears are scarcer, and labour nearly three times as dear as it used to be, we have some small sets-off in the shape of new bridges and improved roads, for all of which we should be duly thankful. Then we had no grievances in those

days; but this source of unhappiness has now been removed, and is there not the Munzerabad Planters' Association which ventilates whatever woes can be found?

And here it may not be out of place to say a few words as to the treatment the planters in Mysore have received at the hands of Government from the days of Sir Mark Cubbon to the present time. Whatever may be the case with planters in other parts of India, and however much they may have to say, I feel sure that in Mysore at least the planters have always been treated with an unvarying courtesy and consideration which merit all the acknowledgments that could possibly be recorded. We have not, of course, got all we want. Who has? But everything that could reasonably be granted we have had cheerfully and ungrudgingly; and because, as a person who has consistently endeavoured to obtain what can be got, I have naturally advocated reduction of taxation and improvements in the means of communication, it does not therefore follow that I should fail to own, and be glad to own, that our Governors have been ever good and kindly men, who did all they could for us, as members of that community which was committed to their charge. The only point we had any real reason to talk about was, that our taxation was, as compared with the taxation in the Queen's territories, unreasonably high. Instead of an acreage tax, as levied in the imperial territories, we have a duty or excise tax of 2*s.* a cwt., which amounts at the lowest to 10*s.* an acre, and on fairly good crops to at least 14*s.*, while the acreage tax of Coorg amounts only to 4*s.* an acre. It is true that, in bad seasons, our tax falls with the amount of our crops, but even then it is far in

excess of the rates prevailing in the Queen's territories. All this was duly represented to Mr. Bowring, and he recommended a reduction of the tax to 1*s.* 6*d.* a cwt., which, however, the Governor-General in council, why and wherefore does not appear, refused to sanction. It may be alleged that a tax on the produce naturally encouraged a careless and slovenly cultivation, that the tax came heaviest per acre on the best cultivated, and hence the system itself was radically bad. But it was just one of those systems which were admirably suited to the situation; for the natives produced at least five times the produce that Europeans did, and it is certain that under an acreage tax the native cultivation would have been much discouraged, while the smallness of the patches of land which they cultivated would have rendered it impossible for Europeans to absorb what would have been left entirely waste had an acreage tax been adopted. All that a native had to do was to put down in his garden, or in any patch of jungle near his house, a few plants, which grew as they best could while he was sleeping, and the produce, when sold to the native merchant, was taxed when he carried it beyond the frontier to the west, or into the next county towards the east. Now, cultivated in the slovenly native fashion, or rather not cultivated at all, the tree bears little or nothing for six or seven years, and if, previous to the plant coming into bearing, the farmer had to pay tax, he would never have put down a plant at all; and therefore this system, apparently bad, and contrary to all the laws of what is commonly called political economy, answered so well that the natives became richer, and the Government coffers fuller. It might, of course, be urged that the system should now be altered, but the

survey would be costly, and, from the minute subdivision of patches, and from the fact of every one putting down a few trees around his house, an amount of trouble and annoyance would arise, and opportunities for extortion would be brought about, which would more than counterbalance all the advantages that could possibly be imagined from a system theoretically the best. It is to be hoped, therefore, that the present system may be let alone, and, if it can be proved that the taxation is higher than that existing elsewhere, the duty should be reduced to such an extent as to equalise the taxation to what it would be under the acreage tax in British territory. If this reform was carried out, the Mysore planters would indeed be in a sad state, for they would not have a single substantial grievance left that I am aware of. As, however, the Government does not seem at all disposed to come down in its demands, it is tolerably certain that this isolated grievance will furnish us with a bone to pick for many a year to come.

Having thus said something of the way the Government has got on with us, it now remains to say a few words as to how we get on with it, and with the officials who represent it. And here I find that we have very little to say. We have always got on with Government officials, and they have always got on with us. The fact was, we recognised our position, and did not talk about our rights. In truth, the British settler in India has no business to talk about his rights at all, or to magnify his importance in any way. I can easily see that the infusion of a few energetic Europeans can start a new industry, and give an impetus to every sort of industrial enterprise; but when people talk about settlers strengthening the hands of Government, it seems

to me that something extremely like nonsense is being uttered. I can quite understand the presence of a few scattered settlers, or rather capitalists (for to call us settlers is a mere misnomer), weakening the hands of Government in troubled times, and I can quite understand the tendency often shown to make a great fuss because roads and works are not undertaken which are to benefit the Britisher in isolated situations, and enable him to get his produce to market; but what strength is to accrue to Government I am really at a loss to understand. Nor does it require more than a moment's reflection to see that, supposing disturbances to occur in Mysore, there would be a tremendous howl raised if the Government, at the first sign of danger, did not detach troops to secure the safety and property of the planters in the province. In Mysore, however, I think the planters have recognised themselves at their proper value; and just because they have done so, do I think that the Government has been all the more disposed to do what it could for them. And here I may be allowed to hint for the benefit of Indian settlers in general, that there is a great deal in the way of putting things, and a great deal also in selecting judicious times for introducing one's wants to the notice of the official mind. An idea that may seem unreasonable and troublesome during the worry and heat of the day, or even after the fatigues of the day are over, will appear far from being either the one or the other if introduced after breakfast. Supposing, then, that the official of your district is going to pay you a visit, you should be careful to have everything prepared in the way of comfort that you can possibly think of, and make no mention of anything that you and your neighbours want till breakfast is finished.

Then, when the official, refreshed with his bath and comforted by his breakfast, throws himself back in his chair and lights his cheroot, and when he has smoked the pipe of peace for about three minutes, then is the time to hint of that new line of road that you want, of the advantages that would arise from the improvement of a road that perhaps stands much in need of it, or of the erection of a bridge which would add materially to your comfort and to the value of your property. At these moments the official mind is more thoroughly open to the reception of truth than at any other time I know of, and if in these precious moments you cannot successfully insinuate your wants, you may depend upon it that your demands must be very unreasonable indeed.

Another hint I may be allowed to offer is, that a settler should, above all things, manage his affairs without constantly applying here and applying there for Government assistance, and especially for regulations which may aid him more effectually in apprehending runaway coolies. The fact is that improvements in the methods of apprehension lead to no good result, and only end in plantation-managers being more careless than ever in making advances without adequate security, or sufficient inquiry into the character of the people to whom advances are made for the procuring of labour. My managers in India have standing orders on no account to go into a court; and I do not think that within the last ten years either myself or my managers have ever been in a court except once, and that was with the view of recovering a few advances from people who had undertaken to procure labour from a distance. In fact, since my estates were started in 1855, though I have advanced sums from a few shillings

per man up to £5, and even more, I do not think I have lost, in all that time, more than £40 or £50, and some part of that sum was on account of deaths. Where the means of apprehension are ready and cheap, planters will advance sums of money to men whom they know nothing of, to procure labour; and I have known labour procured in this way all the way from Bangalore (one hundred and forty miles distant), the man employed to procure the coolies picking up any one he could find, without caring anything at all as to character. The coolies arrive, and shortly bolt to Bangalore; then the planter has the men apprehended and posted out to the estate, merely to bolt again on the next opportunity. Now, this carelessness naturally puts the officials of all classes to more or less trouble, and I need not, therefore, say more as to the advisability of resolving to manage your affairs without any Government aid whatever.

After this long, but I hope not altogether useless digression, it is time to turn the attention of the reader to coffee and coffee-planting, from which I do not mean to depart till the end of the chapter.

I dare say that most of my readers are familiar with the shape of the coffee of commerce, and if they are not, they have only to look into any grocer's shop-window to see that it is a bluish-green seed, or berry, of an oblong shape, flat on one side, with a groove down the centre, and rounded on the other. If you take two of these seeds, cover each of them with a brittle husk, place the two flat sides together, and cover the two husk-enveloped seeds with a soft pulpy substance of a cherry red, and with a smooth shiny skin, you have then ripe coffee as picked from the tree. And when you see berries of a round shape, commonly called pea-berries, all you have

to do is to cover each with the brittle parchment, and with the pulp as before, and you will then have ripe pea-berry cherry coffee, which, I may particularly explain, has only one rounded berry, instead of the two flat-sided ones found in ordinary coffee. This pea-berry coffee seldom occurs in young and vigorous trees, and seems to result from weakness or age, for it is mostly to be met with in old or diseased coffee-trees. This berry used generally, at one time, to fetch a higher price than the flat-sided ones, in consequence of an idea prevailing that it was of superior flavour, and perhaps also from the fact that it was, from its shape, more easily and perfectly roasted; but, for a good many years past, I have observed that we obtain the highest price for the largest-sized flat-sided berries. I need hardly tell the reader that there is an enormous difference in the value of particular kinds of coffee; but the reader will probably be surprised to find that from the same tree, and in the same season, coffee is commonly picked that varies in value from 50*s*. to perhaps 90*s*. or 100*s*. per cwt.—the berries that the tree has not strength enough to perfect and ripen forming the first, and the last consisting, of course, of the largest and choicest fruits. Besides these descriptions of ordinary coffee and pea-berry coffee, there is a third kind, which is known as monkey or jackal coffee, about which a good deal of misunderstanding seems to have prevailed. Accordingly, we find that Dr. Shortt asserts, in his "Handbook of Planting for Southern India," "that all planters know that what is termed jackal coffee is held in greater estimation than what is called planter's coffee. Why should this be the case?" he asks; "and why should such a difference be caused by the berries passing

through the intestinal canal of a jackal?" But the question as to why jackal coffee excels other coffee is unfortunately liable to the same test as the question that was once put to a learned society of, "Why does not a tub full of water overflow when a fish is put into it?" And the reader may recollect that, after a long discussion, the whole question was solved by some one proposing to put a fish into a tub full of water, which being done, and the water being found to overflow, the whole question fell to the ground. The fact is that jackal coffee, so called, has very little to do with the intestines of that or any other animal. It consists principally of coffee that has been knocked off the trees, or spilt by the pickers, of green berries that will not ripen, and of stray berries that have dried on the trees. Along with all this are occasionally picked up a few of those stercoraceous deposits to which Dr. Shortt imagines that such a high value is attached, and hence the name of jackal or monkey coffee is given to these tail-end scrapings of the crop. But monkeys and jackals are not the only animals that are fond of this sweet, syrup-tasted pulp, for dogs, pigs, cats, and birds seem to be equally desirous of consuming as much of the crop as they can eat, and the worst of it is that they seem to digest it, or rather the pulp, and get rid of the seeds with extraordinary rapidity. Spirit, of course, can easily be made from the pulp, and I believe that this has often been done in Ceylon and in the West Indies, but in India I never heard of the pulp being used for anything but manure.

Having thus said as much about the berry as the reader will probably care to hear, we may now say a few words as to the appearance of the plant. And here

I think it hardly worth while to give any botanical details regarding the tree further than to say that it belongs to the order of *Cinchonaceæ*, in which, I may remind the reader, are classed the quinine-yielding trees which have been so successfully introduced into India. It will be more to the purpose if I advance to a description which I hope will be fairly intelligible to the general reader.

I may commence, then, by observing that a full-grown coffee-tree, if allowed to attain its natural height, resembles very closely a Portugal laurel which has sprung up rather tall and slim. In fact, the likeness is so exact that, at a distance of thirty or forty yards, it would be difficult to tell one shrub from the other. When, however, the coffee-tree is topped at the height of between four and five feet, which it usually is by the European planter, the resemblance is not quite so striking, as, in comparing it with an under-sized Portugal laurel, we shall at once be struck with the less regular and more bushy appearance of the latter. But the resemblance is even then tolerably close, and is at least a great deal more so than to any shrub I know of in these islands. But the growth of the coffee-tree is infinitely more regular than that of the laurel. The branches spring in opposite pairs from the stem, and each pair shoots out at right angles to the pair above and the pair below; thus, supposing that the pair below shoots out north and south, the pair above will grow east and west, and so on alternately. To this rule I have observed only one exception, and that is where three branches spring out all up the tree in place of the usual pair. But this is very rare, and I have never met with more than two or three instances of it. The leaves spring in pairs from the branches, and at the

base of the leaves the blossom-buds are formed. The blossoms, when fully developed, are clustered together, and present, at a little distance, much the appearance of a bunch of white hawthorn, though in smell and form each blossom resembles jasmine more nearly than any other flower I know of. To each cluster there are from ten to twenty and even thirty and thirty-two blossoms, which, if the season is a good one, produce as many berries, so that from a single cluster of berries upwards of sixty seeds may be produced. The blossom remains in full beauty for a few days only. It then rapidly fades and falls, and is succeeded by the miniature berry, which comes to perfection in from six to eight months, and, till the ripening stage commences, is of a green colour. When the berry is ripe, it is spoken of as cherry coffee, from its resemblance to that fruit. The coffee-tree is tap-rooted, and the wood of a yellowish white, and so hard that it has been used with advantage for woodcuts. A stem of ordinary size is about three inches in diameter: the stem bark of the fully-grown tree is of a greyish white, the newly-grown branch bark of a light brown.

Having thus endeavoured to describe the general appearance of the tree, with its flowers and fruits, I shall now write down as briefly as possible the methods usually pursued in growing it.

The coffee-plant may be propagated either by cuttings, buddings, or by seed; but I have never known it to be propagated by the planters by either of the first two methods; and, as it is evident that they must be troublesome and objectionable from a variety of reasons, I shall confine my observations entirely to the last method of propagating the plant; and, while doing so,

shall, at the same time, give the results of my experience as to the formation of nurseries.

And here I may observe, at the outset, that there is no branch of planting of more importance, and none that I have seen so frequently mismanaged and neglected, as the production of the plant in the nursery. In the fine coffee-growing climate of Ceylon the production of nursery plants must, I should think, be a comparatively easy matter, but, with our long droughts and withering east winds, the greatest care and the most constant watching are absolutely necessary to the attainment of success. And the first thing of importance to be noticed is, of course, the advisability of having your nursery as close as possible to your house. On my estate we have always been the most successful plant-growers in the district; and though this may have been in part attributable to our excellent command of water, the fact of the nursery being only a hundred yards from the bungalow had, I suspect, not a little to say to the result. The next point to be considered as regards nurseries is, that it is far cheaper to carry soil to water than water to soil. In selecting, then, a place for a nursery, such a command of water as will enable you to flood every bed, and so to thoroughly saturate the soil, is indispensable; and if you cannot get a good supply of water on forest land by forming a tank or diverting a stream, you will find it the cheapest plan, in the end, to transport jungle soil to the depth of a foot or eighteen inches, and lay it down on any land which has command of water. A couple of boys will irrigate effectually a large nursery if the water can be conducted to each bed, while twenty men or women will be required to carry water as many yards to a nursery of the same

size, and even then the beds will be at best but half watered. And yet I have seen a neighbour of mine, day after day and month after month, employ at least twenty women in watering a nursery by hand. But cheapness alone is not the only advantage to be gained by flooding the beds; for this process of watering can be carried on at any time of day, while, without scorching the leaves, watering-pots cannot be used except early in the morning and late in the afternoon, or rather evening.

Supposing that your nursery can be formed, as it of course should be, if possible, on forest land, the jungle should be felled, cut up, and carried or rolled off the ground, and not, as is commonly done, burnt on it. This plan, I am aware, is expensive, but I am confident that it will be found to pay well, as the surface mould is not injured, and the friable nature of the soil is thus preserved intact. And I need not employ much time in pointing out that a fire, by consuming the vegetable matter on the surface, renders the soil more tenacious, and less suitable to the springing of the seed. The beds should never exceed five feet in breadth, and each bed should be about sixteen feet in length. Between the first row of beds and the second, and so on at the foot of each row of beds, shallow channels should be cut, along which water can be conducted to the head of each bed; and in these channels during the dry season water should be allowed to run continuously. It will percolate gradually into the land, and so keep it cool and moist. During the hot weather the longitudinal division between the beds should consist of earth heaped up to the height of about three inches. This will not only render the flooding of the beds more complete, but will

prevent them drying up as rapidly as they otherwise would. These raised divisions should be removed in the monsoon, and each division converted into a channel, to convey away the superfluous rain-water. Thus, in the monsoon, at every five feet (the beds are 5 feet wide by 16 feet long) you will have a drain, and in the dry weather a little ridge of earth between each bed.

As regards seed there is very little to be said. It should, of course, as a matter of precaution, be selected from the finest and healthiest trees, and consist of the finest berries you can find. These precautions are, however, seldom attended to; nor have I been able to ascertain any facts which tend to show that plants from carefully-selected seeds are any better than others; for I have put down seeds from trees, both native and plantation, of all ages, and in every kind of way,—pulped by machinery, pulped by hand, not pulped at all, quite fresh, and six months old,—and could never perceive any difference in the way the seeds came up, or in the plants produced from them. As a matter of convenience, however, I should prefer separating the seeds from the pulp, and putting them down in drills. In the drills the seed should be put down at least a quarter of an inch apart, and between the drills should be left a space of from four to five inches. The thinnings may be either transplanted or thrown away. The seed should be put down in March or April, and in fourteen months you ought to have excellent plants if the soil consists of virgin land. Where, however, a crop of plants has been previously taken from the soil, the seed should be put down a month or two earlier. Some planters, I may here observe, put down in the nursery seedlings that have sprung up under the old coffee-trees; but this is a

plan no one should adopt who can readily procure seed, and especially where the supply of water is good. During the hot-weather months the young plants should be shaded in this way:—Posts about four feet high, with forked heads, should be driven into the ground at the corner of each bed. Long sticks should then be laid from post to post, then cross-sticks, then date grass, or, what I have found to be the best, reeds that are commonly to be found growing in the ravines of the jungle. Some months before the plants are required this shade should be judiciously thinned, and ultimately removed altogether, in order to harden off the plants by exposure to the sun. The plant too, at that time, should be grown nearly to the size required, and should be stinted of water and brought to a stand-still, in order that the head of the plant and the extremities of the branches may solidify; for, if your plant is put out in the plantation with newly-formed and tender shoots, it runs a great risk of being nipped off by the scorching rays of the sun, which (and in occasional seasons this is not unlikely to happen) sometimes makes its appearance when you have reason to expect a continuance of rainy, or at least cloudy, weather.

In concluding these remarks on this important branch of planting I may add that where the nursery is at all exposed to dry east winds, the walks and divisions between each row of beds should be thickly planted with roses and fruit trees, as these not only add to the appearance of the nursery, but are extremely valuable as shelter. In short, the nursery on a well-conducted plantation ought to be a pleasure to see at any time of the year; and if the ground is on a slope, and neatly cut into terraces, with water running in the channels, and

fruit trees—as the peach, the locust, the pomegranate, apple, and pear—growing along the water-courses, the reader can easily understand that it is impossible to say too much in favour of paying all possible attention to what ought to be the pleasantest feature in the whole plantation.

The next point that claims our attention is the clearing of the forest; and here it is not too much to say that the experience and example of Ceylon planters have more than half ruined planting in many parts of India, and a great deal more than half ruined it in Mysore and Coorg. In Ceylon the climate is oceanic; in many districts rain falls more or less during eight months out of the twelve; and in some, I believe, there is seldom a month that is certain to be without a shower. But in India we have a climate exactly the reverse of all this. We have, it is true, a rainfall which is in the aggregate, I believe, equal to, or even exceeding, that of Ceylon; but then we have the rain in certain consecutive wet months, which are followed by many months of cloudless skies and parching winds. The south-west monsoon breaks along the western shores of India with terrific force towards the end of May, and from then up to the end of September we have almost continuous rain. In October the weather is showery; but towards the end of the month all signs of rain disappear, and it is quite a matter of chance whether a single drop of rain may fall within the next four months and a half, and in one season we had nearly six months without a single shower. But this is not all. The winds from November till early in March are mostly from the north-east; and a glance at the map of India will show the reader that the breeze must sweep over many hundreds of miles

before it reaches the Western Ghauts, and I need not waste words in explaining that a land-wind which has swept over so many miles of scorching plain must necessarily be of the most arid and withering nature. And yet, in spite of these obvious objections to planting without shade or shelter, planters of the greatest Ceylon experience have been employed by Indian proprietors, and in many instances they have themselves adopted an experience derived from a totally different climate, and an experience which they have obstinately refused to modify until taught, by the bitterest lessons, that a method of cultivation suited to one climate may be entirely unsuited to another. But it unfortunately happens that errors once committed in the formation of coffee plantations cannot be easily remedied. It is easy to cut down shade and shelter, but it requires years to build it up again; and it is melancholy to behold the uphill efforts of men to replace what, a few years before, they had irretrievably destroyed. Ceylon planters flocked into Coorg, and a sufficient number found their way into Mysore to cause an enormous loss to those who were foolish enough to adopt the experience that was earned in Ceylon, the greatest of coffee-planting countries. The fruits of that experience we know too well. Taught by what was an ample and sufficient experience in a moist and oceanic climate, those who had shade to preserve their coffee in the long dry months cut it down as fast as possible, and numerous plantations were formed where not a tree was left standing, and where shade was scouted as a thing of the past, and as a relic of barbarous times. The planters cut down the forest and planted their coffee; and then came dry seasons and sickly plants, and an insect called the borer, which aided in

killing the trees from one end of the plantation almost, and in many instances quite, to the other. When I last visited Coorg, in 1865, I recollect telling the superintendent of the district that I was then going to England, and that on my return to India I certainly expected that many of those plantations, which were then so promising, would probably be used for firewood, and that many an acre in my own district would share the same fate. But, though confidently predicting the inevitable result, I confess that, when I returned to India in the spring of 1867, the result had far exceeded my expectations. The season of 1865 was dry and hot, and the season of 1866 had been worse; and during the last two months of 1865 and the first four months of 1866 there was not, on our side of the country, I think, a single shower to revive the drooping plants. It was then seen, but in many instances seen too late, that a wall is no stronger than its weakest point; that the weak point in our climate is bound occasionally to appear sooner or later, and that, when it does, it is sure to be accompanied by that enormous increase of insect life which invariably accompanies long droughts and dry seasons in any quarter of the globe. And here it will naturally be asked why it was that shade and shelter had been so universally neglected. One of the reasons I have already given; and the fact that experienced Ceylon planters were looked up to in India as the safest guides was, of course, one of the principal reasons. But there was another, which had probably as much to do with the matter; for it had been practically found on the Neilgherry Hills (on Mr. Ochterlony's plantations, I think) that the coffee planted in the belts of forest trees left for shelter was a total failure. The plant grew

slowly, the branches were poor and lanky, and the yield was trifling, and there seemed to be some fatal objection to growing coffee in shade at all. And the same thing was found elsewhere; and many instances of the same sort may be pointed to in other districts. It was therefore held that coffee under shade would not do, because, in many instances, it would not do under the shade of the old forest trees. But no one seems to have asked whether it would not do under shade of another description; and the idea of cutting down the whole forest, allowing a secondary growth of forest trees to spring up, and supplementing that by planting trees which were most suitable for coffee shade, seems to have been an experiment that no one thought of trying in Southern India until it was adopted by myself and a few other planters in Mysore. But the droughts and the borer together have at last opened the eyes of even the most prejudiced planters, and it is now pretty generally admitted that a light shade is no loss in any season, and that in the driest ones it is absolutely necessary, to preserve the plantation from the attacks of insects. Further on in this chapter I shall have occasion to call the attention of the reader to some other advantages of shade; but enough has here been said to show that shaded plantations are the safest in climates like that of India; and I shall therefore at once proceed to give the results of my experience as to the difficult task of opening a shade plantation.

When I entered Mysore in 1855 there was no such thing thought of as planting coffee without shade; and the natives and the few Europeans that were there simply cleared the underwood, put down the plants, thinned out a large tree here and there, and killed others

by ringing them. The general result was, that the plantation could not, at a little distance, be distinguished from virgin forest; and you might walk about all day, and seldom be for a moment in the sun. Under those circumstances, however, the growth of the plant was excessively slow, and the yield, for many years at least, by no means sufficient to satisfy the demands of European planters. But from one extreme the European planters soon went to the other; and a Ceylon planter of skill and experience having entered the district in 1855, the first open plantation was commenced the year following, in what would have been considered by Ceylon men the only possible way of growing coffee. The forest was felled and burnt, and not a single green thing but coffee was allowed to be seen. This gentleman from Ceylon had, however, selected the wettest part of the district, and for a good many years there seemed little reason for deciding finally against unshaded coffee; but when the land came to be exhausted by crops, and when the dry seasons came often, he was obliged to acknowledge the mistake he had made; and when I was last in India he could talk about little else than the best way of growing shade, and of the trees best adapted for that purpose. But the lead thus given was followed out in parts of the country where the rainfall was far smaller and the heat far greater, and where even the most desperate planter from Ceylon would hardly, I should think, have ventured to attempt growing coffee without shade. And here, of course, the result was not long doubtful. The plants grew at a great pace; and it was argued that if they could stand the heat when they were young, they would be all the more able to stand it at a more advanced age. But the fallacy of this mode

of reasoning was soon shown; and the trees, after yielding a few crops, and often not more than one or two, simply perished off the face of the earth; and hundreds of acres of coffee which, five or six years ago, promised fortunes to the owners, have now been entirely abandoned.

The lands in the districts of Munzerabad and Coorg (and I should think that this may probably be the case with most Indian coffee districts) may be divided into two classes; firstly, those in the wettest, and generally the most mountainous, parts of the country; and, secondly, those in the driest, and generally less hilly, parts of the district which lie nearest to the east, and are therefore further from the influence of the rains of the south-west monsoon. In the wettest parts of the district coffee cannot be grown with advantage under the shade of the forest trees, while, in the drier, it can be most advantageously grown under the shade of the largest trees. The method of planting should, therefore, be entirely different. In the most western parts of the district the whole forest should be felled, and secondary shade be allowed to spring up; while, in the eastern part, it has been found better to clear the underwood and a few of the smaller trees, and ring out a sufficient number of the others, leaving more or less according to the aspect, and to the general lay of the ground. And here, before detailing the best mode of proceeding when opening a shade plantation, I think it advisable to make some remarks as regards aspect, with reference both to sun and wind, as, before commencing to clear, the planter should take considerable pains to ascertain the values of the different aspects, with the view of regulating the amount of shade accordingly.

In considering, then, in the first place, aspect as regards sun and heat, I may observe that it is impossible to exaggerate the importance of carefully estimating the value of the various exposures. For the effects the sun's rays have on certain aspects, in heating the soil and drying up the plant, are such as would be extremely difficult to believe, had the facts not been verified by competent observers, and with the aid of the thermometer. And as regards northern and southern slopes in particular, we shall find that the difference between one exposure and the other is just what constitutes the difference between green and dried grass, and between leaves luxuriously green and leaves dry and withered. And that the first is literally true may be seen by any one in the months of January and February; for in those months you will see the grass on northern aspects green, and, comparatively speaking, fresh, while, even in a valley sheltered from drying winds, the grass on the southern slopes is completely withered. And you will see an equally striking difference in the coffee-plants; those on the northern slopes full of health and life, while those on the southern ones are yellow, drooping, and sickly. Even in parts of the district where coffee will not thrive without a considerable amount of shade, you will always find the plants thrive well with little, or even none, on a northern bank, and look better than on a moderately-shaded southern aspect. Nor in the nursery is the effect of aspect at all less striking; and a nursery on a northern slope will require far less water, and far less shade over the young plants, than in the case of a nursery sloping to the south. But Mr. MacIvor, the able superintendent of the Government Cinchona plantation, has tested the value of northern

and southern aspects in a way which can leave no doubt as to their respective merits. He accordingly tells us that "the reason why a northern exposure in these latitudes is beneficial is from the fact that it is much more moist during the dry season than a southern aspect, because the sun's declination is southerly during the dry and cloudless season of the year, and thus, on the northern slopes, the rays of the sun do not penetrate and parch the soil. A northern aspect has also the advantage of preserving a much more uniform temperature than a southern aspect, because the excessive radiation and evaporation on the southern slopes greatly reduce the temperature at night, while, in the day, they are heated to excess by the action of the sun's rays striking the surface at nearly right angles. The practical effects of aspect on the plants are so great that they cannot be overlooked with impunity; and, in order to impress this on the mind of all who may have the selection of localities for Cinchona cultivation, I may mention that the difference of temperature is almost incredible; for example, at this elevation,* a thermometer laid on the surface of the southern face of a hill exposed to the sun at three P.M. will frequently indicate from 130° to 160° Fahr.; the same thermometer, if left in its position, and examined at six A.M., will generally be observed to indicate from 30° to 40°; while, on a similar slope, if selected with a northern aspect, the thermometer, under the same circumstances, at three P.M., will generally indicate from 70° to 80°, and at six A.M. from 40° to 50°." The extreme difference, then, between a northern slope and a southern one, as regards heat, is exactly the difference between

* Probably about 7,000 feet.

80° and 160°; and as these results were obtained at the Neilgherry Hills, which are thousands of feet higher than most of our coffee plantations, I need not employ more space in urging the importance of attending carefully to aspects; and, in judging of the value of an estate, or a piece of forest out of which it is proposed to form one, it is plain that the price one would be disposed to give should be largely influenced by the lay of the land. I do not know whether Mr. MacIvor has extended his observation to eastern and western slopes. From my own observation I do not imagine there would be found to be much difference between them; but it would be very satisfactory to have their value carefully estimated, and I regret that I am unable to supply any decisive evidence on the point.

Turning now to a consideration of aspect as regards wind, we shall at once find that the subject is an infinitely more difficult one than aspect as regards the sun's rays, the value of which can be mathematically ascertained; for, in a country full of hills and ravines, one is constantly liable to be deceived as to the points that are exposed, and those which are sheltered from the force of the wind. Then it is extremely difficult, even in the case of a single district, to lay down any rule which shall guide a man in determining as to what wind is to be most dreaded in the particular spot he has selected. What is the right side of the hill for one planter is often the wrong side for another whose estate is, perhaps, only a few miles distant. While one calls out against the west, another is equally loud against the east wind. The winds, however, which are most to be dreaded, as being absolutely fatal to coffee, are those fierce monsoon gales which, accompanied by torrents of

rain, burst along the whole of the Western Ghauts. These winds are injurious in two ways. In the first place, the plant is blown about, its hold on the soil weakened, and the tender rootlets broken as fast as they are formed; and, in the next place, the rain which comes along with the wind is driven into the hillsides with such force as to occasion a serious amount of wash, the particles of soil are I may even say lifted, and the consequence is that hundreds of tons of the most valuable top soil are swept away and utterly lost. These south-west winds are, however, only fatally injurious on the first barrier of hills they strike. Further inland their force is greatly modified, and to such an extent that little injury results from them. For instance, along the whole of the westerly frontier range of the Mysore table-land coffee can hardly be grown at all in the teeth of the south-west monsoon, and eastern aspects are therefore the best; while, five miles further inland, an eastern aspect, from the climate being so much drier and hotter, is most to be avoided, and a western aspect may be considered rather favourable than otherwise. But, as regards south-west winds, another difficulty presents itself. You know, perhaps, that they are bad in certain localities, but you will find it by no means an easy matter to determine what aspects are blown and what sheltered. And in estimating the value of exposures, planters—and men of some experience too—are frequently deceived. Aspects that you think must be exposed are often untouched by the wind, while on others, apparently sheltered, it bursts with tremendous force. I have, for instance, on my own property, land with an almost northern aspect which is injuriously affected by the south-west monsoon blast,

which, being at that point pent in by the hills, sweeps in gusts direct from the north. Of aspect as regards wind there are, however, two points which may fairly be relied upon: the first is the appearance of the soil on the slopes, and the second the inclination of the forest trees. The soils on windy slopes will be found invariably to present a hardened and washed appearance, and are, comparatively speaking, deficient in decayed vegetable matter on the surface. Why, in a forest where the wind and rain are so greatly broken by the trees, the soil should have this appearance on one aspect more than on another, it is difficult to account for. But, as far as my observation goes, the fact is as I state it, and I am not the only planter who has come to the same conclusion. The inclination of the trees, too, and especially the extent to which their heads are bent, will often tell you which way, and how forcibly, the wind strikes. But in many instances it is difficult, from the closely-grown nature of the forest, to arrive at any satisfactory conclusion, and the only test that may be said to be generally reliable is the appearance of the soil on the slopes.

In summing up these remarks on this (for India, at least) most important point of aspect, I may observe that, as regards the sun's rays, it is plain that a northern aspect is the best, and a southern one the worst, because the latter is exactly twice as hot as the former. And, as regards the eastern and western aspects, we came to the conclusion that there was not, as regards heat arising from the sun's rays, much to choose between them.

As regards aspects as affected by wind, we came to the conclusion that, on the westerly aspects of the frontier barrier of mountains, on which the south-west

monsoon bursts, coffee can hardly be grown at all, and that easterly aspects were therefore the most valuable. And it was pointed out that, in the case of plantations further inland, in consequence of the south-west gales having expended their force so greatly on the first range of mountains, and partly in consequence of the climate being drier and hotter, a western aspect was to be preferred to an eastern one. In conclusion, I may observe that, the prevailing winds being south-west and north-east, no notice is therefore required to be taken of the other aspects as regards wind.

Keeping these conclusions as regards aspect plainly in mind, we will now, in the first place, advance to the method of opening an inland plantation, where coffee can be grown with advantage under the original forest shade; and, in the next place, we will turn our attention to the opening of what may be called a ghaut forest, where, from causes that have been previously pointed out, coffee cannot be grown to advantage under the shade of the forest trees.

In opening, then, a plantation of coffee which is to be shaded by preserving a portion of the original forest trees, the first thing to be done is, after having ascertained the amount of land that can conveniently be planted in one season, to clear a wide road through the underwood from one end of the block of forest to the other, and as many roads at right angles to the line as may facilitate your getting about and thoroughly inspecting the land to be cleared. The next thing to be done is to cut another wide line round the entire portion to be cleared, leaving, of course, a belt of from fifteen to twenty yards wide as a sort of margin, which is always to be kept uncleared. This marginal belt will

be found useful for shelter; and it must be borne in mind, too, that the margins of jungle are generally composed of land into which the forest has more recently extended itself, and which is, therefore, generally poor and less adapted to the growth of the plant. The preliminary lines having been cleared, the whole of the underwood should then be cut down from one end of the forest to the other, and while it is yet green, such portions of the longer sticks as it may be difficult, from their weight or length, to drag along the ground, should be cut into one or more pieces. Supposing, then, that the land is broken by deep ravines, as is commonly the case with coffee lands, the axemen should set to work and fell down bodily the bottoms of such ravines, which, from the forest trees on the upper parts of the slopes being left standing, will thus have ample shade. And the northern slopes of ravines running from south to north may be almost entirely cleared, leaving, of course, around the head of the ravine, such an amount of standing forest as may be sufficient to cast a long shade down the slope. The result, then, of these operations will be, that your ravines which have a watershed to the north will be entirely cut down, the bottoms of all other ravines will also be cut down, and the rest of the clearing will have all the forest trees standing, and the underwood cut away entirely. Supposing that all this is completed by the end of December, the underwood may then be piled in heaps at a distance from the foot of the forest trees (which, as I have found by a melancholy experience, are easily destroyed if their bark is at all injured), and burnt in detail. And a little further on, when the larger trees felled in the ravines have become thoroughly dried, the ravines that have

been cleared should be set fire to. But the greatest care must be taken to prevent a running fire going through the whole clearing, as anything of the kind will be entirely fatal to the trees you wish to preserve for shade.

The land having been thus thoroughly cleared, lines of road should be laid out, and the usual operations of lining and pit-digging (which may be learnt from any of the coffee-planting books) carried out, and the plants put down in the earliest breaks of the monsoon.

By this process a great deal more shade will have been left than will ultimately be required, but I have practically found that it is impossible to clear down at once all the trees you wish to get rid of, as, if you did so, you would have such a fire as would entirely consume the trees you wish to preserve; and it is therefore necessary to complete your clearing during the season following. Such trees, then, as you may wish further to remove must be marked, and, as may seem most convenient, some may be thrown down judiciously between the rows of coffee, and others, which may be likely to do much damage, may have their branches lopped off, and be barked by cutting a ring round them a few feet from the ground. The amount of shade to be left must, of course, be regulated according to the value of the exposure, as shown in the remarks on aspect.* Such, then, briefly is the result of a long experience in making shaded plantations, and I can confidently recommend this method to all those who are ever likely to be engaged in planting coffee in the hotter and drier parts of India.

Turning our attention now, in the second place, to

* The reader need hardly be reminded that a great deal of shade will be required on southern slopes, very little on northern ones, and that eastern and western slopes require a moderate degree of shade.

making a shade plantation where the coffee will not grow, or cannot be grown to advantage, under the shade of the lofty forest trees, we shall find a great deal less to say, for cutting down a block of forest from one end to the other is about one of the simplest operations imaginable, and has been so often described in other planting books that I need not waste time in going over ground that has been so often traversed before. We will suppose at once, then, that the jungle is felled, and burnt off in one of those tremendous conflagrations which incinerate and consume the soil, and which, in planters' language, result in a good clean burn. We will suppose the land lined, holed, and planted up in due order, and that you wish to replace some of the shade you have destroyed. And here you cannot do better than follow the example of nature, or rather let nature, for the most part, work her own way, and augment her resources by judiciously adding to the number of trees of a kind favourable to coffee, and which will naturally spring up. When a forest is cleared and burned, there springs up with the first rains, and in great abundance, a tree which is known by the name of the charcoal-tree. This is a tree which invariably springs up wherever a piece of jungle is felled and burnt, and is evidently intended by nature as a shade for the harder and more permanent woods, which require shade and shelter just as much as the coffee-plant itself does. This charcoal-tree is a poor, soft, white, watery wood, and is so light that a large club of it, when thoroughly dried, weighs rather less than a moderately-sized walking-stick. In two years from the time of its springing, this tree will form an ample shade for coffee, but as it gets older the foliage becomes poor and thin; and as the

tree itself affords thus, in the course of time, but a poor shade, and as it is extremely liable to die out and to be blown down, and as, further, as far as my experience goes, it is at any rate a short-lived tree, it is plain that it should be regarded merely as a temporary shade, to be got rid of whenever the permanent shade trees have grown sufficiently large to be able to do without shade themselves, and to afford shade to the coffee-plants. And this charcoal-tree is particularly well suited for the purpose of a temporary shade, as, from the branches being extremely light, it can easily be removed at any time without doing any injury to the coffee. I am, I may here observe, most particularly desirous of calling the attention of planters to my experience of this tree, as, from remarks I have at various times read in the Indian newspapers, and from what I have heard generally, I am afraid there is a disposition to rely upon it exclusively for shade, and I feel confident that to look upon it as a satisfactory permanent shade will only lead to disappointment and loss.*

The next point to be attended to is, to plant out such kinds of woods as are particularly suited to coffee, and to remove any kinds of trees which experience has proved to be injurious. When I first entered Mysore it was very well known that the jack-tree was particularly suitable to coffee shade, but no one seems to have observed that many kinds of trees were positively poisonous to coffee, and that several other kinds were nearly as good as jack. But a long observation has now considerably extended our knowledge as regards trees suitable for coffee shade, and also of the best methods of propagating them.

* See Appendix E.

Of all these trees suitable to coffee I am inclined to place the jack at the head. From Ceylon planters I admit that I have heard very contradictory accounts of this tree; some asserting it to be indifferent, and even injurious, while I have been informed by others that some very fine estates in Ceylon have numerous jack-trees scattered about amongst the coffee. But whatever may be the case elsewhere, there can be little doubt that any planter in Mysore who could find a forest with sufficient jack-trees to form shade for the coffee, would be able to build up an estate that would last for an almost indefinite period. But the growth, however, of this tree is unfortunately extremely slow, and the only means of safely and satisfactorily propagating it is by seed, a plentiful supply of which should be secured, and in the monsoon planted in all the corners which are unlikely to be disturbed by the weeders, or in the angles of the stumps of trees which have buttresses to them, in the stumps of hollow trees, or amongst logs, or alongside of those huge stems of trees on which the fire has been able to make no impression; and when they have sprung up to the height of a few inches a peg should be put next them, in order to mark them, and especially to prevent careless coolies mistaking them for weeds.

The tree next in value, and which some think of equal value, is the cub-bussaree tree, which has a fine dark green leaf, and under which coffee thrives capitally. This tree has a great advantage over jack, because it can be propagated by cuttings. These should be made at about a month before the commencement of the monsoon, and to the length of about eight feet, with a thickness of about four or five inches in diameter. Holes should be dug for the reception of the cuttings, which

will seldom be found to fail if ordinary care be taken with them.

In my opinion the two trees last alluded to stand far in advance of all others, but there are two more kinds which can be propagated by cuttings, and these are the banian and the goni-tree, both of which are considered to make a good shade for coffee.

Of the trees which spring naturally, I have found the utee-maia to be about the best, being fast growing and yielding a very good shade.

There are many other trees which spring up spontaneously, or from the stools or roots from the felled trees, which are more or less good for coffee; but information as to them can readily be had from the natives of the country, and I do not, therefore, think it necessary to add anything to the leading and essential points I have alluded to.

Of the trees injurious to coffee I may particularly mention the taree, cheppul, and muttee.*

As the permanent shade trees spring up, the same care must be taken of them as is taken of trees in this country. Where, for instance, there are two stems, it will be advantageous to remove one of them, and the lower branches should, when the tree springs up to a height of seven or eight feet, be judiciously removed, as the object is to grow a tree not only luxuriant, but lofty, in order that it may throw a long shadow, and so afford greater protection to the plants in its vicinity.

In concluding these remarks upon shaded plantations, I may observe that the common idea prevailing as to the extent to which large trees absorb the resources of the

* I have had a list made of trees suitable and unsuitable for coffee, but do not quote them, as I have been unable to procure the botanical names for them.

soil, and so rob the plant that the settler is principally interested in, is entirely erroneous; for if the trees take somewhat from the soil, they also return a great deal to it, and I do not think that I can do better than quote at length some observations by Mr. George MacDonald, which conclusively show that a soil gains rather than loses by the growth of forest trees.

"An autumnal or old leaf," says Mr. MacDonald, "yields, upon analysis, a very much larger proportion of earthy matter than a vernal leaf, which, being yet young, has not received within its cells any considerable deposit. It will be found, also, that the leaves contain a very much higher percentage of mineral matter than the wood of the trunk. The dried leaves of the elm contain eleven per cent. of ashes (earthy matter), while the wood contains less than two per cent.; the leaves of the willow eighteen times as much as the wood; the leaves of the beech an excess over the wood a small fraction less; the leaves of the European oak nineteen times as much as the wood; and those of the pitch-pine twelve times as much as the wood. It is very plain from these facts that, in forests, the mineral ingredients of the soil perform a sort of circulation; entering the root, they are deposited in the leaf; then, with its fall to the earth, and by its decay, they are restored to the soil, again to travel their circuit. Forest soils, therefore, instead of being impoverished by the growth of trees, receive back annually the greatest proportion of those mineral elements necessary to the tree, and besides, much organised matter received from the atmosphere; such soils, therefore, are gaining instead of losing. Leaf manure," he continues, "has always been held in high estimation by gardeners. But many regard

it as a purely vegetable substance, whereas it is the best mineral matter that can be applied to the soil."

Now, though none of the trees that I would preserve are deciduous, still they do shed annually an enormous quantity of leaves, and under the evergreen jack may always be found a good thick layer of leaves in all stages of decay. And as regards this tree in particular, instead of it robbing the coffee, the coffee seems to rob it; for I have been informed by the natives that jack-trees fall off greatly in their fruit-yielding capabilities if coffee is planted under them. And it must be considered, further, that the large and powerful roots of tap-rooted trees like the jack bring up from great depths in the soil—depths far beyond the reach of the coffee roots—mineral matter which passes into the leaves, and thence on to the surface of the soil, where the coffee feeding-roots most abound. I may here add, what ought to have been mentioned previously, that the jack is liable to be preyed upon when old, and occasionally even when half-grown, by a parasite which is exactly like mistletoe, and which seems to exercise a most injurious influence on the tree. But if this is removed, which it may be by bodily cutting off the boughs amongst which it has grown, the tree will throw off its sickly appearance, and again shoot out in full luxuriance.

I find it impossible to quit this subject of shade without saying a few words as to the numerous advantages that plantations of coffee have that can be grown under the shelter of the original forest. In the first place, from the greater part of the land being only cleared at first of the underwood, and from the fact of that being burnt in separate heaps, a large proportion of the soil is entirely uninjured by fire, and the valuable surface

mould entirely preserved. In the next place, from the preservation of such a portion of this vegetable matter, and from the land being annually recruited by the fallen leaves, the rain-water, instead of running off, washing the land, and so depriving it of a great deal of its most valuable constituents, soaks gradually into and lodges in the soil, without the loss of a single drop. Thirdly, the forest trees afford shelter to innumerable birds, which are not only pleasant to see, and many of them to hear, but which are of incalculable service as insect-eaters. Then the planter with his shade, if he does not altogether laugh at dry seasons, in a great measure neutralises their influence by preventing the sun and wind from drying up the soil and parching the plant. And, finally, both the planter and his people can work away all day, and seldom feel the fierce rays of the tropical sun, and this consideration alone is of immense money value to an estate. And yet, in spite of all these considerations, we have seen shade and shelter ruthlessly cut down all over the country, and often in parts of it so hot and arid that it would be difficult to conceive circumstances that could be more fatal to the existence of coffee.

The next branch of planting that more particularly demands especial attention is that of putting down the coffee-plants at the best possible distance from one another. And here it has occurred to me, and I have no doubt to many others, that planters are very apt to fix on some arbitrary distance, without any particular reference to the qualities of the soil and to the general lay of the land. Some prefer planting the trees very closely together, while others advocate the allowance of more room; but you will seldom find that distances are altered, as they should be, in accordance with the poor-

ness or richness of the soil. Now, it seems sufficiently obvious that the richer and stronger your land is, the greater distance should your plants be apart, and that the poorer and more exposed portions of the estate (for the two commonly go together) should have the plants put down more thickly. And as roads are generally made across the slopes, and about midway up them, it may be laid down as a general rule that the plants above roads should be planted far closer than those in the richer soil below. Thus, if 6ft. by 6ft. is found to be a convenient distance in your best land, 4½ft. by 5½ft. will be found to be the best distance in the poorer and more exposed portion above roads. The great object, it must always be borne in mind, is to cover your soil, in order better to shade it, and to keep down weeds, and at the same time to leave enough room between the rows to allow of the coolies passing up and down the lines with ease, or with such ease that they can get about without forcing their way and breaking the branches. And bearing these objects in mind, a planter should regulate his distances carefully in accordance with his soil, aspect, and climate. It may, of course, sometimes happen that a very favourable conjunction of all three may grow a tree that requires more room than even 6ft. by 6ft., and in that case a few more inches should be allowed, and it may also happen that even 4½ft. by 5½ft. may be too far apart. But on these points a settler must in a great measure rely upon his own judgment, and these remarks are mainly intended to caution the planter against fixing on any arbitrary distance as being the best.

Having thus said something on nurseries, clearing, and planting, it is now time to turn our attention to pruning,

and in that term I include all operations, as topping, handling, and taking off suckers, or, as planters call them, gormandisers.

The coffee-tree, if allowed to grow to its natural height, will commonly be found to measure from twelve to fifteen feet, and trees of that size may often be seen around the houses of the farmers in my neighbourhood. But the European planter reduces his shrubs to, at the most, four feet and a half, and sometimes to as little as three feet, and in windy and exposed situations two feet and a half have often been adopted as the best height. And here, as in the distances most advisable to plant at, the planter should be partly guided by the soil, and partly by the aspect as regards wind. In thoroughly sheltered situations, and in the finest land, a tree may be allowed four feet and a half with advantage, but in all medium situations as regards soil and exposure I should be inclined to limit the tree to four feet, or even a few inches less, and in poor exposed situations three feet will be found to be an ample allowance. The height of the trees having been carefully determined on, the next thing to do is to consider the best time for topping them at; and here we shall find some difference of opinion prevailing as to whether the trees should be topped at the green wood, and whether, if topped at the brown wood, they should be topped before or after the blossoming season. Topping at the green wood is a process only employed, I conceive, by those who are short-sighted enough to prefer picking a heavy maiden crop to having recourse to measures which tend to give a small maiden crop, and are best for the general constitution of the plant. Dismissing, then, the subject of topping the tree when it has just attained the height you wish to keep it at, I will assume that

topping at the brown fully-developed bark is the only practice which is the safest and most sensible; and the only question then left to consider is as to whether this topping should be performed before or after the blossoming season. And here, again, the planter should boldly sacrifice his coffee in order to add to the permanent strength of the tree; and as topping before the blossoming season has a tendency to turn out a heavy crop on the primary branches, the tree should invariably be topped just after the blossom has bloomed. In cutting down the tree to the height you wish to have it at, you will, of course, cut off several pairs of branches, with their blossoms; but this sacrifice will be amply repaid by the strength that will thus be added to the young tree, and by the advantage of having a small crop on the primary branches below.

One of the principal faults in coffee grown under shade is its invariable tendency to throw out long, straight, primary branches, which are extremely slow in growing secondary shoots; and the evil of this is that the first crop is entirely borne on the primaries, which are thus so bent downwards as to give the branch a permanent curved set. The higher branches, having thus obtained a decided droop, shut in those below them, and, from the primary itself bearing heavily, these branches, instead of growing thick and strong from the first, are thrown back, and it is long before they recover from the weedy and shrunken appearance caused by a heavy crop. Now, the only way of obviating these evils is, when the tree is about two years old, to nip off the point of each primary; and this will be found to have the effect of making the branches throw out secondaries at once, and, by limiting the length of the primary branch, it will not be bent down by the weight

of fruit, which, as I have shown, causes the branches to have a permanent downward set. I observe that this plan is alluded to by writers on Ceylon coffee, but a Ceylon planter of experience has told me that the tendency of the tree there is to throw out secondaries far sooner than the trees in Munzerabad do, and in that case, of course, the method alluded to would be unnecessary.

After a tree has been topped it soon throws out shoots all over the stem and branches, and the early removal of the shoots on the stem, and the thinning of those on the branches, are things that require to be immediately attended to. When these shoots are young and tender they are easily removed without injury to the bark of the tree; but if they are left to harden, their removal becomes at once injurious to the tree and expensive to the planter. The shoots on the stem, which are commonly called gormandisers, require, of course, to be entirely removed. But the shoots on the branches require careful thinning, and this is a point on which too much personal experience cannot possibly be bestowed; for, if this work is fully attended to for a year after the tree has been topped, the work of pruning in future years will be easy and simple, whereas, if the trees are neglected at this stage, the difficulty of getting them into form is such as no one who has not had charge of a neglected estate can have any idea of. The first thing to be done is to clear out the centre of the tree by removing all shoots within about four inches of the stem, in order to admit light through the body of the tree; and the next thing is to remove all shoots growing backwards, downwards, or across the tree. When all these are removed it will generally be found that sufficient has been done, but on very luxuriant trees the shoots growing in the right direction will still be too

numerous, and will require further thinning, so as to reduce the number to two shoots at every joint of the branch. If this process of handling be fully and regularly attended to, there will be very little and very simple work for the knife to do, and the pruner may generally be directed merely to remove the very driest and oldest secondaries, and shorten back such primaries as may be long and whippy. I am aware that in Ceylon it is recommended that a secondary that has borne one crop should be removed, and where you have a fine coffee-growing climate like that of Ceylon, it is evidently advantageous to do so; but in our climate, with its long droughts, it has been found that nature will not grow wood fast enough to allow of that practice, and that we must merely content ourselves with removing wood that is superfluous, or that will bear no longer. A slight alteration may be made from this rule in the case of those luxuriant trees in the bottoms of deep ravines, which throw out wood with greater rapidity; but, with that exception, the planter will find that he cannot afford to do what his brother planters in Ceylon can do with advantage.

I have said that if the tree is not carefully kept in order at the outset, the difficulty of getting it into form will be very great, as old neglected trees present an impenetrable mass of twisted branches which are a perfect puzzle to the pruner; and, where the tree has been long neglected, the lower branches die off altogether, leaving merely a sort of matted umbrella at the top of the tree. In despair of ever getting such trees gradually into a tolerably good form, I have seen planters reducing them to a mass of straight primaries, or, in other words, I have seen them cut off every crooked, twisted, or back-growing branch, and end by leaving a tree which looks not unlike

an umbrella minus the cloth. By this process a year's crop is, of course, sacrificed, and an immense amount of handling is required to reduce the redundant green wood which springs out all over the tree. But these old neglected trees may easily, with a little patience, be got into good order far more cheaply, and without any sacrifice of crop. The first thing to be done is simply to cut out all secondaries and tertiaries that are past bearing, and to clear out the centre of the head of the tree. The removal of this superfluous wood will be followed by a sufficiently rapid growth of young wood, which should be carefully handled; and, after the next crop, a fair proportion of cross branches may be cut out, but only to such an extent as not to diminish the prospects of crop. By the next year a great deal of your young wood will have come into bearing condition, and then you may deal more vigorously with cross and crooked branches. Altogether I have found, in the management of old and neglected trees, that in about three years they may be got into fairly good order without the slightest sacrifice of coffee. Pruning should, if possible, be all got over before the blossoming season; but when you are confining yourself to the removal of plainly superfluous wood that is past bearing, or has perhaps only a berry or two on it, pruning may be continued, without injury or inconvenience, up to the commencement of the rains in May.

The ground we have hitherto traversed has been plain and easy, and the reasons either in favour or against particular methods of raising, planting, and managing the tree are such as can readily be brought to the test of experience; but the subject I have now to handle, involving as it does questions of agricultural chemistry, and being, besides, extremely difficult of exact proof,

is one that admits of no easy settlement. The subject, however, of coffee-manuring has engaged my attention for a good many years, and, with the aid of the most experienced agricultural chemist in this country, and guided also in some measure by another well-known chemist, I have at last arrived at some conclusions which will at least form a fair base for future investigations. But, before giving the reader the results of my observation, it may be of use and interest to say something as to the analysis of the tree and of the berry it produces.

In Dr. Shortt's "Handbook on Coffee-planting in Southern India" the reader will find an account of a minute and careful examination made by that gentleman into the constituents of the entire tree, and, without troubling the reader with the details, I may give the result of the analysis. It was as follows:—

	lbs.	oz.	drs.
Water lost by drying . . .	7	8	0
Organic matter	9	13	10½
Ash	0	6	5½

This result, I must mention, was obtained from a double-stemmed tree, indicating a twin origin, and no less than fifteen feet high, which was taken up, roots and all, and on which there was some coffee, which appears to have been analysed along with the tree. But I do not think we need consider that the small amount of coffee being present could have much altered the analysis, as the leaves, twigs, and fruits taken together, and when thoroughly dried, only weighed 1lb. We may therefore consider, I think, for all practical purposes, that the analysis of the ash is the analysis of the tree alone, without its berries. The 6oz. 5½drs. of ash then showed the following result:—

Potassa	15·76
Soda	18·98
Lime	26·07
Magnesia	4·26
Sesqui-oxide of iron	9·22
Phosphoric acid	13·28
Sulphuric acid	2·79
Chloride of sodium	8·35
Silica	1·29
	100·00

Now this result, it must be remembered, was obtained from a double-stemmed tree more than three times the height of an ordinary plantation tree; and, making every allowance for the fact that the tree was, as stated by Dr. Shortt, a lanky one, and consequently with poor, weak branches, I do not think we can go far wrong in estimating that the mineral taken from the soil, and held in suspension by the plant, cannot exceed 4oz. per tree; and assuming that an acre be planted at the ordinary distance of 6ft. by 6ft., the permanent demand made upon the soil for the mineral support of the plant will amount, in round numbers, to 302lbs. per acre. And when we come to consider that, from the prunings being invariably returned to the soil, this demand is made once for all, it is plain that we need not give ourselves much concern as to supplying the mineral loss caused to the soil by the growth of the tree. When, however, we turn to the organic matter of the tree, we shall find that a considerable call has been made on the soil, and if we assume that the organic matter amounts to 5lbs. per tree, we shall find that 6,050lbs. per acre are held in suspension by the plant; and though some portion of this is derived from the air, the call on the soil for organic matter must be considerable, and this is no

doubt the reason why it has been found impossible to grow the tree at all on any but forest soil. You may plant coffee on the deepest and finest soil, not twenty yards from where the plant can be grown on forest land with the greatest advantage, and yet not be able to produce a tree at all; and were it not for this well-established fact, it is plain that the coffee production of districts like Munzerabad might be almost indefinitely extended, instead of being confined, as it is at present, within extremely narrow limits. But, besides what is held in suspension, there is a great demand for growing power in the tree itself, in order to provide a rapid growth of new wood to replace that which is past bearing, and has to be cut away; and there is, consequently, a considerable demand for foliage-making manures. The prunings and handled-out shoots will, of course, return their organic matter to the soil; but a great and rapid power of growing wood is essential, and the tree must, therefore, be so well fed as to cause a rush of wood, a large proportion of which will have to be thrown away. If these remarks be correct, it seems evident that, as regards the growth of the tree, we need pay little attention to mineral, while we require to pay a great deal of attention to what are called nitrogenous manures.*

Turning now to the coffee of commerce, we shall find that no part of it can possibly return to the soil in any shape. Its entire constituents must be replaced, and liberally replaced, if the estates are to last, and the trees to maintain their original bearing capabilities. And here I must observe, at the outset, that there seems to have been a strong tendency, amongst those who have started

* Nitrogenous manures, too, being easily washed out of the soil, require to be all the more liberally supplied.

on a theoretical basis, to exaggerate the effects of mineral manures, and to maintain that those alone are the principles of support mainly to be relied on. These advocates of mineral manures have started on the basis that the constituents of the berry, as shown in the ash, are the things that it is requisite alone to replace; and, relying on that view, we find a manure like that of Tytler's Sombreorum put forward as the best, because it contains in large proportion a mineral which forms rather more than fifty per cent. of the ash of the coffee seed. Now, at first sight, it would certainly seem that, finding that half, or rather more than half, of the coffee-berry ash consists of potash, we could not go wrong in allowing potash a very high rank in our list of manures; and accordingly we find that Tytler's Sombreorum, which professes to be a mineral manure, consists of rather more than forty per cent. of potash. But when we come to inquire into the experiments regarding potash, which, I may observe, forms about half the ash of most seeds, we shall find that no reliable results have, in this country, ever been obtained from the use of potash as a manure. And I may here mention that Professor Anderson, of Glasgow University, informs me that "the results of all the experiments made with potash have in general shown that much dependence cannot be placed on it. With turnips," he continues, "this is certainly true, and with other crops it appears only in particular circumstances that it produces any effect whatever." I do not, of course, pretend to say that when the soil has, during a long course of crops, been much drawn upon as regards this alkali, to apply a small proportion of potash as a manure would not, in all probability, be followed by favourable results; but to adopt for perma-

nent use at the outset, and to pay a high price for a manure containing upwards of forty per cent. of a substance of doubtful and unascertained value, seems to me rather a hazardous experiment. I would, therefore, recommend that people desirous of ascertaining the value of potash should buy it separately in the shape of the muriate of potash, and carefully ascertain its effects before committing themselves to an expensive outlay as regards a manure like Sombreorum, which has, no doubt, produced valuable effects, but which cannot, as far as I can see, be shown to have produced any remarkable effect from the forty per cent. of potash it contains.

In continuing my remarks upon coffee-manuring, I think it convenient to notice in order such manures as are readily available, and which are most cheaply and easily applied.

The manure that has been most freely applied, and which, I believe, has been most relied upon in Ceylon, is cattle dung; and, with the view of keeping up a regular supply of it, many estates keep considerable stocks of cattle, which are in most instances, I believe, stall fed with grass and oil-cake. But here we shall find in India a fatal obstacle in the climate; for while in Ceylon grass can readily be grown almost all the year round, in Mysore it will be found impossible to provide any quantity of grass for even any part of the year, and you would have to graze your cattle all day in order to support them at all. But not only would you lose an enormous quantity of manure by so doing, but, in consequence of the poor condition that cattle thus grazed must necessarily be in, what could be obtained by their dung would be poor and worthless stuff. And, further,

I find that even in England the excrements of grass-fed cattle (that is, cattle fed in meadows alone) are of no great value; and Mr. MacDonald, in his valuable work, points out that in 1,000lbs. of the dung of such cattle there are only 4lbs. of nitrogen, 3lbs. of phosphoric acid, and 4lbs. of lime. But, besides the fatal objections I have alluded to, there are others which serve to show that it is only under very favourable circumstances that cattle manure could be used with advantage. The first is the bulky nature of the manure, and the consequent cost and labour of application; and the second, and one by no means to be lightly thought of, is the great risk of losing your stock by disease. In fact, this latter consideration alone would always be sufficient to deter me (and I think it ought to deter any one in India) from depending on a manurial source which would be liable to be suddenly cut off, and which could not be replaced without the expenditure of a great deal of time, expense, and trouble. Some planters in our district—and I observe that the practice is common in Ceylon—collect the manure at the halting-places where pack and cart bullocks put up for the night. But if the manurial value of grass-fed cattle in England be small, it is evident that that of lean, hard-worked, grass and straw fed cattle must be infinitely smaller, and that the fact of the cart cattle getting a small quantity of boiled grain (a sort of pea) daily would not materially add to the value of their dung. But this practice of collecting manure has been entirely abandoned by us, and I do not think that any one would be likely to take to it again. Although, however, cattle manure should not be depended on as a reliable manurial source of any great

value, it by no means follows that it should be entirely neglected. The cart cattle on the estate should be well fed with grain and oil-cake, and as they are only worked for a small portion of the year, their dung may be looked upon as of considerable value. To these a few more cattle may be added, and these may be gradually allowed to increase by breeding; and if you keep the number down to a quantity that you can find ample grazing for near home, their manure will form a welcome addition to that of your more valuable and well-fed stock. And if to the manure thus obtained you add that of the stable, which there is generally a fair supply of, and add to the heap the ashes, sheep-dung, and sweepings from about the house, you will then have a very good sample of farm-yard manure; and it is from such a manure as this, combined with bones, that most valuable results have been obtained on my estate.

The next manure which calls for a few remarks is bone manure, and the value of this for all crops and in all countries, combined with its extreme portability and cheapness of application, renders it by far the most important of fertilisers for coffee. I have never used bones dissolved, as they commonly are, with sulphuric acid, but have simply broken them into pieces of about a quarter of an inch in length, and accelerated their further disintegration by mixing them up with coffee pulp. The latter, being a moist substance, not only prevents the bone-dust being blown away, but, when heaped up with a mixture of pulp, the heat that is thereby generated seems to exercise a considerable effect on such portions of the bones as have not been fully smashed. Another very good plan is to make a heap of alternate layers of farm-yard manure and bones; and

it is in that way that I have formed compost of bones and farm-yard manure for application to the land.

I have said that the best result on my property has been obtained by farm-yard manure * and bones; and if a sufficient quantity of the first substance could be readily and cheaply obtained, there is no doubt that these two manures would make us for ever independent of any other aid. But, from what has been previously said, it is evident that we must have recourse to some other nitrogenous manure; for bones, though valuable as berry producers, fail, when used alone, to give that dark green leaf, and that growth of strong young wood, which it is absolutely necessary to produce. In the course of my investigations it was suggested to me that the nitrate of potash would probably supply all the nitrogen requisite, and would, besides, supply the soil with a considerable proportion of potash. I accordingly purchased some tons of this substance in India; and though I have not had an opportunity of conducting the experiment in person, I can confidently rely upon the observation of my manager, whose experience, it is satisfactory to find, accords with the theoretical principle, and coincides with the general experience of farmers in this country, who find that phosphates and nitrogen surpass all other manures in value. He accordingly informs me that, as far as he can see, farm-yard manure and bones are best, and next to those he would place the nitrate of potash † and bones. It may

* This, it must be borne in mind, was a mixture of horse, cattle, and sheep manure, wood ashes, and general sweepings.

† Subsequent communications confirm the value of the nitrate of potash, and the trees manured with that salt show a dark leaf, and have thrown out not only more numerous, but far stronger shoots than trees that have had bones alone, or bones and the muriate of potash. My manager reports that he can observe no results at all from the muriate of potash, nor has he been able to observe any

be urged, however, that the effect might, in no small degree, have been owing to the potash, and not to the nitrogen contained in the salt applied; but, in Professor Anderson's opinion, the effect was probably due to the nitrogen rather than to the potash. But this is a question which yet remains to be practically decided; and, with the view of coming to a conclusion in the matter, I have sent to India some tons of the muriate and chloride of potash, which will show conclusively the value of that mineral by itself. Considering, however, that farm-yard manure and bones have been proved to give the best result, it seems to me that it will probably be found that Professor Anderson is right in his conjecture as to the effects from the nitrate of potash having been produced by the nitrogen, and not by the potash. But however this may be, it would seem that in bones and the nitrate of potash taken together we can supply all the requirements of the plant; and if, as is the case in shade plantations, a large supply of leaf manure be supplied annually, it seems to me that nothing further is required. The plants and berries demand phosphate of lime, nitrogen, and potash, and these substances are therefore all supplied when we manure with bones and the nitrate of potash. Other substances, it is true—as magnesia—are removed from the soil, but in such very small quantities that it seems to me they are not worth taking into account.

Supposing that I am correct in my assumption as to

results from the use of Tytler's Sombreorum. Another planter in our district has equally failed to observe any results from the use of the last-named manure. But these experiments must, for the present, be merely considered as tentative. I may add that the muriate of potash, which was bought in this country at £8 per ton, came to about £22 per ton when delivered on the estate, while Tytler's Sombreorum came to no less than £28 per ton.

bones and the nitrate of potash supplying all we require, there yet remains the question as to whether our phosphate of lime, our nitrogen and potash, cannot be more cheaply supplied than through the manures I have indicated; and that question I now propose briefly to consider.

Bones are valuable on account of the large proportion of phosphate of lime they contain, and which varies considerably in particular animals. It is found in a greater proportion in the bones of aged animals, which abound more in the mineral, and less in the proportion of animal, matter than do the bones of younger animals. But the average per-centage may be said to vary from fifty to sixty per cent. In order to save carriage, and in consideration of the small value of the animal matter of the bones, it has been a common practice to calcine them; and no doubt, where bones have to be brought from a great distance, it would pay better to do so. I have never considered it worth while to do so myself, as the bones I procured were not brought from such a distance as to make it worth my while. But when bones are brought, as they often are, from Australia to Ceylon, or from long distances—as, say, three or four hundred miles by land—it seems evident that the animal matter lost by burning could be far more profitably supplied from some other source. But, sooner or later, the supply of bones must become exhausted, or insufficient to meet the increasing demand; and it then becomes a matter of importance to look to the mineral phosphate of lime as a substitute, as that is nearly, if not quite, equal to the animal phosphate. This mineral phosphate exists in the shape of coprolites and also of apatite; the first being the fossilised dung and bones of animals,

and the second being a rock which largely abounds in phosphate of lime. I am informed that in the Punjaub there exist considerable beds of fossil bones, but in Southern India I have not been able to ascertain that the mineral phosphate of lime exists in any shape whatever. As, however, I have never heard of any one looking for it, that is not very surprising. Some years ago I wrote to the Commissioner of Mysore on the subject, and, from the inquiries he instituted, the mineral does not appear to exist in the province. But I apprehend that this mineral phosphate does probably exist somewhere, and as its discovery is evidently a matter of very great importance, I repeat the simple test for detecting its presence; and were this test placed in the hands of all engineers and district officers, we should soon ascertain whether this valuable manure does or does not exist.

Test to ascertain the presence of the mineral phosphate of lime:—To a small portion of the substance to be examined add a little muriatic acid. Heat slightly, then add ammonia. Milk-white precipitate will show the presence of phosphate of lime.

As the importance of discovering this mineral is of much consequence to coffee-planters in India, I would suggest that the various Planters' Associations should exert themselves in the matter, and I think it might perhaps be of use if they offered a medal, or premium of some sort, for the discovery of an available bed of the mineral phosphate.

The principal objection to the use of the nitrate of potash is its great cost, and that put down by me came to £24 6*s.* 10*d.* on the estate; and it seems to me that that is too high a price to pay for an artificial manure

for it to come into exclusive use. But it is here that we find the pressing want of information as regards the resources of particular parts of India. This is promised to be remedied by a Gazetteer which is to be brought out by Government, but at the present moment I have no means of ascertaining anything regarding the means of procuring this substance, or whether cheaper means might not be discovered of supplying it; and I think that the Planters' Associations ought at once to collect information on the subject, with the view of ascertaining the chances of being able to procure this manure at a cheaper rate than it is possible to do at present.*

At the commencement of these remarks on coffee-manuring I said that I thought I had arrived at some conclusions which might form a basis for future investigations, and if the remarks I have hazarded are of any value, it seems that what planters should do is—

1. To ascertain by careful experiment the value of potash as a manure for coffee.

2. In the next place, they should try and discover an available bed of the mineral phosphate of lime in India.

3. They should endeavour to find out whether the nitrate of potash cannot be supplied at a cheaper rate than it can be procured at present.

4. The proper season for applying various manures should be ascertained. (My own idea is that mineral manures might be put down at any time of year, but that ammoniacal manures should be applied at the close of the rains, as they are so easily washed out of the soil.)

5. The fifth question to be determined is—How far does it pay to carry the volatile portions of bones? or, in

* I observe in the Indian Museum samples of nitrate of potash from Errode, Nellore, and Moganore, in the Madras Presidency.

other words, does it pay best to transport unburnt bones from, say, a distance of fifty miles, or does it pay best to calcine them, and transport the phosphate of lime only?

But of all these points the first is the most important to ascertain, and I would strongly urge the Planters' Associations in Southern India to institute some careful experiments with the muriate of potash, and should it be proved that potash is of itself a valuable manure, no doubt can then remain as to the expediency of using the nitrate of potash as a standing manure for coffee.

I have now noticed all those points in coffee-planting which, from the general nature of the climate, call for particular notice when writing on coffee-planting in India.* As regards all the other points connected with planting—as roads and drains; picking, curing, and despatching of coffee; bungalows and labourers' houses; stores, pulping-houses, and barbecues; tools and machinery; weeding, &c.—I cannot do better than refer the reader to an excellent work, entitled "The Coffee Planter of Ceylon," by Mr. William Labonadière. There is, however, one point I have omitted to notice, and that is that, from the dryness of the Indian climate during the picking season, a very small store only is needed. In fact, so seldom do we have any rain in the picking season, that it is common for the coffee to leave the estate without ever having been in a 'store at all, as the moment a sufficient quantity is dried it is despatched for shipment.

And now for a few remarks as to the cost and prospect of planting. How much can an individual start on safely? As far as my experience goes, I should say not less than £5,000. As for what can be got for

* See Appendix F.

that sum, the question cannot, from the shifting nature of prices, and the varieties of climate, soils, and situations, be accurately answered, or with even an approximation to accuracy, so I shall not attempt to answer it at all. The planter must just cut his coat according to his cloth as he goes along, or, to use a Canarese proverb, "stretch his legs according to his blanket." He may get a very large return, or a moderate one, or a small one; and he may even gain, as many an unfortunate man has done, a considerable loss. I would particularly warn any man who thinks of taking to coffee against relying on those estimates which are so often published, and which, though perhaps accurate enough as far as they go, assume that everything goes well, that you have a good soil, climate, and labour market, good health, and good seasons; and which, after a brilliant account of the returns that may be expected for the first few bearing years, usually terminate with the assertion that (I quote verbatim from a work on coffee) "the profits subsequently will be something fabulous." The fact is that the difficulties in the way of forming accurate agricultural statistics are, in any country, almost insuperable, as there is either a tendency to exaggerate or depreciate the yield, as it may suit the interests of the cultivators. And then, as regards coffee in particular, there is no means whatever of estimating the produce. I might tell the reader the results of estates under my own management. Besides this, I could tell him a good deal that I have heard, but very little that I know, in the way a man generally requires to know anything which he wishes to publish as reasonably near the mark. And here I may observe that the assertions one often hears are monstrous in the general, though they may be perfectly true in particular and exceptional

instances. "In my district," you will hear it said, "I've known an estate give a ton an acre." And just in the same way you may hear of a man in England talking of a prize ox or the weight of a monster egg; but that proves very little as regards the general size of eggs and oxen. Nor need the monster eggs and oxen enter into a man's calculations. As long as he observes that fowls and fat oxen pay, he may pretty safely breed them, and trust to fortune and judgment for the rest. So, in going into coffee in any district, it signifies not a straw whether you know what certain acres have yielded, or what amount of profits may be expected. But there is one guide to the value of a district which may firmly be relied on. If estates frequently change hands it is certainly a bad or indifferent one; if seldom, you may be pretty sure that coffee pays very well; and, further than that, a man need give himself no concern, for hardly any landed investment pays so well in India as good sound coffee property, and people are therefore seldom inclined to part with it.

Having ascertained that people are not inclined to drop their estates in a hurry, the settler may commence to look a little further; and the first thing of importance that will attract his attention is the state of the labour market. Now, that district is, of course, the safest which has a command of labourers attached to the soil—men who are, for the most part, engaged for some months of the year on their fields, and who are glad to work on the plantations for the remainder of it. But coffee lands surrounded by fields and villages are now rarely to be had, and, as a rule, imported labour must be depended on. And here a man must not inquire so much into its dearness as its safety; for, if labour can always be pro-

cured in sufficient quantity, it can hardly be so dear as to prevent coffee paying. It pays very well in Ceylon at tenpence a day, and there is no reason why it should not pay at the same rate elsewhere. And, with regard to this question of labour, an eye should be kept to the distant future. The health of the imported labour must be carefully inquired into, and it must also be considered whether, nearer to the sources of the labour market, or even further from these sources, some healthier district may not spring up, to which, at equal rates, labour would rather resort. In making choice of a district, then, other things being equal, a man should prefer that with the safest labour market.

Transport facilities, though certainly deserving of some attention, need not give the settler in India much anxiety, as, by the time that a man has grown something to carry, he will find roads overtaking him in very remote situations. So many considerations, political as well as commercial, exist in favour of opening out the country, that almost any place, however inaccessible at present, has a fair chance of being soon within reach of a road. When I first entered Munzerabad, places we then thought to be remote and inaccessible are now held to be rather in the way than otherwise; and, taking everything into account, I would not advise any man to be deterred from taking up land by transport considerations, supposing that things are as they should be in other respects.

In concluding these remarks upon planting, I may remind the young settler that the first and last thing to be learnt is to keep down expenses. An estate should be started on the assumption that it is not going to pay well, or that you may have to abandon it altogether. A

common thing to do in starting an estate is to build a house at an expense of £350 or even £400. Now, the value of that outlay, if we calculate interest and compound interest, will amount to no small sum before the estate comes into bearing, and, if it is a failure, you just leave so much less cash behind you. If you spend only £20 on a comfortable, mud-walled, thatched house, with a couple of rooms, a store-room, and a bath-room, and if you have a good basement of about four feet, so as to have several steps to ascend before getting into the house, you will find yourself as healthy, and quite as comfortable, as if you had set up with an orthodox bungalow. This is a thing that may be built in the course of time, but it should be built out of profits, and never out of capital. In the same way, when you build your store, you will find a great deal of difference between £350 and as many rupees (£35); and, in climates like those of India, the latter sum ought to be sufficient for a considerable estate, or, if you go as high as £50, it ought to be the outside. It should be built of burnt brick, and with mud instead of mortar; there should be a rough jungle-wood roof, and tiles on the top of that. In selecting a place for a house, do not choose the top of a hill. There is a common idea prevailing in India that those spots are healthiest on which burst the four winds of heaven, and this idea is most commonly to be found amongst medical men. But there never was a greater mistake. The house should be on elevated ground, of course, with a good fall on every side of it to carry off the rain-water, but it should be sheltered from the east wind either by a clump of trees at a little distance, or by selecting a piece of ground which is sheltered from the sweeping, drying, unhealthy, land-

wind. In selecting, too, a site for a house, the importance of having it as close as possible to the pulping-house and drying-ground, and, if possible, to the nursery as well, can hardly be exaggerated. But notwithstanding the obvious advantages of the master's eye, it frequently happens that very little attention is paid to this point, and it is not at all uncommon to see a planter's house, and his nursery and drying-ground, as far apart as possible. I have no doubt, however, that this more often arises from the delusion that you must have a high, exposed situation for your house; but if the planter will only sacrifice that prejudice, he need find no difficulty, as a rule, in concentrating those points of the estate which require the most constant supervision.

A few simple directions may now be given for the conservation of health. The drinking water, in the first place, should be boiled, and then filtered through sand and charcoal. A filter may easily be made with three bottom-perforated chatties (earthen vessels)—the first containing charcoal, the second sand, and the third to receive the filtered water; and about the season of the first rains, at the end of the hot weather, when vegetable matter is largely washed into the springs and streams, care should be particularly taken that the water be regularly boiled and filtered. At this season, too, I have observed that Europeans, as well as natives, are very liable to fever. I would therefore advise every one, during the first or second year, or even annually, to take a few grains of quinine daily till the heavy rains set in, and the country becomes healthy.* Great pains should also be taken to secure regular supplies of well-

* Mosquito curtains of fluffy gauze should always be used, and not those with clean circular holes which have lately come into use.

cooked and varied food; and a cook who can bake good bread and biscuit can hardly be too highly paid, for the settler must look upon his vital powers as so much soil that requires to be well fed and cared for if it is to yield large returns to the owner. An idea seems to prevail with some that it is a fine thing to rough it, and to be careless as to what you have to eat. Now, this may be all very well in Australia and New Zealand, and in healthy climates which are suited to the European constitution; but it must be remembered that all jungly districts are more or less unhealthy, and that if the system once gets below par, you have, by allowing it to be lowered, effectually paved the way to the inroads of fever or of dysentery.

I must now conclude this chapter with some observations on the enemies of the coffee-plant. These are the "borer," the "bug," the "rat," and the "rot," all of them names of much and disagreeable significance.

Towards the end of 1866, and throughout the three years following, large numbers of coffee-trees in Southern India, and in many instances whole plantations, perished clean off the face of the earth. On cutting open the dead trees, large numbers of an insect called by the planters the coffee-borer * were found, and as these insects were almost invariably found in the dead trees, it was concluded that the borer, and the borer alone, was the cause and origin of decay and death. Thereupon there was a tremendous fuss made about this interesting insect. Not even after a man-eating tiger was there ever such a hunt. Pages were written on the insect.

* The earliest notice of the borer that I find is in a Report on the Nuggur Division of Mysore in about 1835, by Mr. Stokes, who notices that coffee-trees in dry seasons often wither and snap off suddenly at the root.

The Government was loudly called upon to exert itself, if it did not want all revenue from coffee suddenly to cease. Nor was the Government long in responding to the call, and accordingly Dr. Bidie was commissioned to go after the borer. As for the unfortunate insect, it was burnt and killed in all possible ways, and, towards the close of 1867, even sent to London to have its history inquired into. It arrived there by the overland route, safely embedded in two coffee-trees, one of which was "cautiously sawed through" by Mr. John Keast Lord. By this gentleman it was declared to be "a beetle of the second family of the *Coleoptera Cerambycidæ*, and to be closely allied to a somewhat common species known as the wasp-beetle (*Clytus avictis*), which usually undergoes its changes in old dry palings." Aided by the head of the Entomological Department of the British Museum, a specimen of the insect was at last found in the collection made by M. Chevrolat somewhere in Southern India. Appended to this specimen was the name of *Xylotrechus quadrupeo*. On a further examination of the tree, Mr. Lord very soon came to the conclusion that the insect did not necessarily cause the death of the tree at all, as it lived on the dead matter of the inner or heart-wood of the stem, and only interfered with the circulation and sap-vessels of the tree when it worked up to the surface of the bark. And he finally was of opinion that "the female beetle, guided by her instincts, selected trees, on, or in, or underneath the bark of which she deposits her eggs, such trees being at the time, from some cause or other not explicable, sickly, and predisposed to early death." Now these causes, which were not, of course, explicable to Mr. Lord, were extremely plain and susceptible of

ready explanation by any planter of experience and observation. Nor am I aware that anything of importance has ever been added to a rather lengthy communication which I published in the *Madras Times* of June 11th, 1867. It was there pointed out that the borer was merely an effect, and not a cause, and that as long as coffee-planters kept plenty of dry, sickly, sapless trees, the result was sure to show itself in an enormous increase of insect life. This was exactly what occurred with our larch plantations in this country. They perished, in many instances, off the face of the earth, and their stems were found to be piped from end to end with borers. But a further examination showed that the roots went first, from various causes, and then the trees got sickly, and then they became full of insects. It was not the insects that caused the sickness, but it was the sickness which caused the insects; and though the insects may have accelerated the death of the trees, it was certain that they were not the cause of the disease. But I need not waste more time in showing that it is a universal law in the vegetable world, and is as true of a tree as a turnip, that, wherever the vital powers decay from any cause, the plant is sure to have its end hastened by insects of some sort or other. Now, what happened in India was simply this. Planters cut down all their shade, and left their coffee-shrubs to take their chance, and hold their own against months of drying winds and scorching suns, and when a few extraordinarily dry seasons occurred, the supply of dry wood being abundant, the breeding-grounds for the borer were almost inexhaustible; and what with the hot suns and the dry winds, and the injury caused by these insects, the trees died by the thousand. Nor did even the coffee

in ample shade escape from the effects of these dry seasons; and in plantations planted, shaded, and carefully cultivated, numerous deaths occurred. But here, of course, the evils of dry seasons were reduced to a minimum; and as the borer does not get on at all well in green and sappy trees, there was, consequently, comparatively little of that insect in the shade plantations. Nor where it does exist in shade plantations is it at all immediately fatal. In fact, as far as my observation goes, a bored tree, if well shaded and well manured, will last for an indefinite period. About thirteen years ago I had charge of a plantation, which I still continue to manage, and one-half of which was an old plantation when I took charge of it. When the estate was purchased I thought it would be a good thing to cut down all the bored trees in the old coffee, but I very soon found that I might as well have cut down the whole plantation from one end to the other. On one occasion I recollect seeing the usual gimlet-hole in a fine tree on the estate in question. The tree looked perfectly fresh and healthy, but, being full of zeal against borers, I cut it down, and, on splitting it up, found that the borer had entered the tree, drilled a hole for a few inches right down the centre, and then made its escape. The fact, I suppose, was, that the borer had made a mistake, that he found the constitution of the tree too strong for him, and that no other borers had thought it worth while to take up their abode in ground that was evidently unsuited to them. Notwithstanding the existence of this insect all over the estate alluded to, it has been one of the most paying in our district, and even after all the losses caused by the dry seasons we have lately suffered from, it has never once gained a loss for its owner.

But, besides the fact of the borer seldom making a fatal attack on a tree which, from being under shade, is kept green and fresh, there are several other causes which, no doubt, tend to diminish the numbers of this insect, and the evil effect it produces. In the first place, shaded plantations are full of insectivorous birds, and when the grub passes into the fly state, and bores its way out of the tree, it runs no small risk of being snapped up before it has time to lay its eggs within the bark of a coffee-tree. Then, again, the timber trees left for shade have many decayed branches, which a borer, as he must live somewhere, would no doubt prefer to coffee kept as fresh and strong as possible. Now, in open plantations there is not a bird to be seen, nor is there any green tree but coffee; and under these circumstances, aided by dry seasons, the plants are inevitably attacked, and, from the coffee being probably fully stocked with large numbers of the grub, its workings, from often approaching the surface of the bark,* and consequently interfering with the circulation of the sap, no doubt aid in hastening the death of the tree to a very considerable extent. Another circumstance which also tells against unshaded coffee is the fact that the first crops are invariably much heavier than those produced by plants under shade, and the natural result is that coffee-trees in the open are proportionally weakened at an early period of their existence; and, as anything that tends to exhaust the tree makes it more open to the attacks of insects, I need not employ more space to show that everything tells against coffee in the open.

I have gone at some length into this subject of the

* The greater the stock of insects, the greater must, of course, be the number of approaches to and through the bark, as each insect has to bore its way out of the tree to make its escape when in the fly state.

borer, because coffee has fallen into undeserved discredit in Southern India in consequence of the notion prevailing that the insect is some special coffee plague, which causes the very existence of a plantation to be a matter of the greatest doubt. But I trust it has now been shown that the ravages of this insect need not be at all dreaded by any man who can, by shade and judicious cropping and cultivation, keep his trees full of life and vigour. If he can comply with the last-named conditions, the planter need not at all dread the losses which dry seasons will undoubtedly entail on all cultivated plants. Let him keep his plants full of life and vigour, and, if he cannot do that, the sooner he returns to England the better.

As we are entirely concerned with planting in India, "the bug," which in many districts is so much dreaded, need not detain us very long. Some of the plantations in Coorg were attacked with it some years ago, but not, I believe, to a serious extent, and in Mysore it is hardly known. The coffee-plants in the open were, without exception, the only ones attacked by it, and when I visited Coorg in 1865 I could hear of no instance of the appearance of this insect where the coffee was under shade. In Ceylon I observe that it is recommended that the plant attacked should be thatched with Marna grass, and I conclude that that would operate in the same way as the shade of a tree. But, however that may be, it is certain that there is in shade something hostile to the bug, and it would be interesting to learn whether my observation in this respect can be confirmed by the conclusions of those who have had their attention called to the subject. A very full account of the bug is given in Sir Emerson Tennent's book on Ceylon, and it is only necessary for the information of the general reader to say

that this insect entirely covers the green wood and leaves of the tree with a black sooty substance, and that the general result is a total loss of the crop. The constitution of the tree, however, is not, I believe, permanently impaired; and if causes hostile to the insect come into operation, the plantation will subsequently prove as successful as if it had never been attacked.

"The rat" is simply an animal of that species which, in many instances in Ceylon, has been a great nuisance. I have had some trees injured by its bark nibblings, but only to a trifling extent, and in India I have never heard of any serious damage arising from it.

Lastly, there is "the rot," and this is simply a kind of decay which seems to come over the leaves and berries during long-continued wet weather, and it appears to arise from an excess of moisture and want of sunshine. On my own property it has operated only to a very trifling extent, but in a plantation which was once opened in the northern division of Mysore it caused a total failure of the property. The trees grew and blossomed, the berries formed, but in the wet weather they simply rotted, or fell to the ground, and the estate was consequently abandoned. The plantation in question was formed under the shade of the original forest trees, and I cannot help thinking that if the whole forest had been cut down, and a light secondary shade allowed to spring up, such a thing as the rot would either not have appeared at all, or appeared to a very trifling extent. I think this point worthy of some attention, as no doubt many new coffee districts may yet be discovered in India, and every phase of the cultivation is therefore of importance.

In concluding this chapter on coffee-planting, I may

observe that, in my opinion, planters have very much neglected the cultivation of many plants that might be grown along with coffee. I must plead guilty, to a certain extent, of having followed the example of my neighbours, but that is no reason why I should not point to what I conceive to be the common error. I mean, then, that planters should put down cinchona-plants amongst the coffee, and in any corner that will hold a few trees; that they should cultivate the swampy ravines with cardamoms; and that they should plant up the margins of their lands with sandal-wood trees. "Be aye sticking in a tree; it will grow while you are sleeping," should never be forgotten. You think you will soon make your fortune and retire. But years and years slip by, and you do not or cannot retire, and then you think, "If I had only stuck in this tree or that tree it would have, in the long-run, added much to the value of my estate." Thus I think of cardamoms, cinchonas, and sandal-wood trees now, and I would, therefore, impress upon the young settler the necessity of doing what I and so many others have persistently neglected.

Since the preceding part of this chapter was finished, my attention has been called to the subject of coffee-leaf tea by a notice in the *Pall Mall Gazette*, as to roasted coffee-leaves having been sold in London as ordinary tea. In the notice alluded to it is asserted that Dr. Gardner, twenty years ago, called the attention of many merchants and chemists to the matter; but "the coffee-planters," it is added, "fearing that the price of the berry would be lowered by the employment of the leaves, contrived to divert from it all general attention." But how this very desirable result was attained the writer does not state. I have said that the result would be desirable,

not because there is any fear of coffee-drinkers taking to an infusion of coffee-leaves, which is, compared with the berry beverage, a poor, flavourless, unpalatable liquid, but because roasted coffee-leaves are probably the cheapest possible things to adulterate tea with, and anything which reduces the price of tea must have, in this country at least, an unfavourable effect on the consumption of coffee. But planters have little to fear from this adulteration in the long-run. What they have to dread is the adulteration of coffee with chicory, which, as has been shown in a previous part of this chapter, is not only injurious, but is a substance of not half the nutritive value of coffee. If coffee adulterators could only find some adulterative substance of equal nutritive value with coffee, we could still hold our own in this country. We have got, indeed, to such a stage of dishonesty, that any one who merely used a substitute of equal nutritive value to coffee would be considered a man of honesty far above the common; and, in the utter failure of our attempts to check adulteration, it might not be out of place at least to pass over all adulterations effected with matter which shall not detract from the nutritive value of the article sold. And it seems to me that, with reference to the standard of morality at present prevailing amongst food-sellers, the condemnation pronounced by the *Pall Mall Gazette* on the dishonesty of substituting roasted coffee-leaves for tea is not a little overstrained.

I may here add that the reader will find a very full account of the value of torrefied coffee-leaves in Dr. Shortt's "Handbook to Coffee-planting in Southern India." That gentleman succeeded in obtaining three samples of roasted coffee-leaves from a planter on the Shevarry, who had taken, it appears, great pains in the

manufacture, and had produced three qualities, which were named successively "Orange Pekoe, Congou, and Souchong." These specimens were submitted to the Agri-Horticultural Society of Madras, through Dr. Hunter; but, much apparently to the disappointment of Dr. Shortt, "the beverage was curtly pronounced to be unpalatable." This coffee-leaf tea, it appears, is largely used by the natives of Sumatra. Dr. Shortt suggests that coffee-planters should take to making it; and if a planter could enter into partnership with a London grocer, and transmit the torrefied leaves direct, to be sold as Assam tea, the thing might no doubt pay in occasional seasons where a planter had little coffee and a great deal of spare leaf. But as it does not seem that more than 3*d.* or 4*d.* per lb.* could be got for the leaf if sold as roasted coffee-leaves, I do not think that the matter is deserving of any attention on the part of planters.

* Since the above was written I observe (*Agricultural Gazette of India*, p. 23) that a London broker has reported on some Ceylon coffee-leaf tea. He values the samples as worth from 1*s.* 2*d.* to 1*s.* 3*d.* per lb., and speaks of them as having "a strong leathery flavour." This sounds pretty well for a beginning, and we are further cheered by the remark that, "if the old-boots flavour could be eliminated, a better price could no doubt be obtained."

CHAPTER XI.

CINCHONA-PLANTING.

To the general reader this chapter may not, perhaps, be very interesting; but to those who, like myself, have lived in the malarious jungles of India, or in any country where fevers are common, the subject will probably be found to be far more interesting than any I could possibly select. For what can be more interesting and more important than the propagation of a medicinal plant which is incomparably the most valuable hitherto discovered by man? And what more noble object can possibly be imagined than that of laying at the door of millions a remedy for those distressing fevers which so often prove quickly fatal, and which still more often curse the frame of man with a lifelong depression? Were you to ask the present generation of Englishmen to say which of all the chapters of Indian history was most interesting, and most decisively showed the advantages of our rule, some would point to our roads, others to our railways, others, again, to our host of legislative enactments; but few would point to the introduction of a humble plant as one of those measures which, as far as man's daily life and comfort are concerned, has more of promise than anything we have ever done for India. But I venture confidently to predict that, when people

write the history of our rule fifty years hence, the efforts that have been made to bring the cultivation of the cinchona to perfection, and the foresight shown in providing the Indians with this valuable medicine, will be appreciated as by far the most valuable fruits of our Indian rule. While, however, we may look forward with confidence to the ultimate success of the cinchona, and to its being planted in every garden throughout the numerous climates suited to its growth, it must not be supposed that in merely introducing the plant we have done all, and that we may now sit down and contemplate the work of our hands with unmingled satisfaction. On the contrary, the most difficult part of the undertaking still remains to be carried out, if we wish for real success. It was a great and arduous task to take the plants from their native home in South America to our hills in India, and the successful method of cultivation now established was the result of long and patient labour; but it was always foreseen that the main object was to lay the plant down to every man's door, and in the voluminous correspondence that has been published by the orders of Parliament this point is repeatedly alluded to. And what has been done towards this crowning-point, without which our labour and our object will have failed so largely? I am afraid we can only answer, Nothing—literally nothing. A few plants have been ordered to be gratuitously supplied to native cultivators, but I can only find that a few hundred were given out, and that the greater part of them died. And here I may pause for one moment to remark, that in the whole history of our rule there is no more striking instance at once of our humane and disinterested intentions, and of our inconsistency and utter feebleness of

purpose. We have exercised arbitrary power with the most incredible rashness. We have forced on the people, without for one moment consulting their tastes and wishes, laws and regulations and a system of government which they detest. We have done all that at the point of the bayonet, and yet we hesitate at exercising arbitrary power in matters about which there can be no manner of dispute. If there is a single point connected with ruling natives on which arbitrary power could be exercised with the least possible loss of popularity, it is the forcible introduction of this valuable medicinal plant; and I venture to assert that, were the Government to collect all the head men of a fever-stricken district, and put it to them whether or no a law should be passed ordering that every native, under pain of punishment, should rear a certain number of cinchona-plants in his garden, a universal assent would readily be given. It is a mistake to suppose that the people have any objection to the exercise of arbitrary power as long as the objects of it are clearly explained to them, and as long as they understand that the exercise of power is to be of general advantage. But I need not weary the reader with further remarks on this subject. Enough has been said to show that, having forced so many unpalatable things down the throat of the Indians, we need have little scruple in carrying out our system of arbitrary law-making a little further, and stretch it sufficiently to insure the propagation of a plant which is of such great importance, not only to the peoples of India, but to the whole world.

It is my intention now to give the reader some account of cinchona-planting in India, and of the conclusions arrived at regarding the various febrifuge

principles existing in the bark; but before doing so, and considering that the subject must, comparatively speaking, be little familiar to the English reader, it may not be uninteresting if we first of all glance at the general history of the tree, and our earliest knowledge of its valuable qualities. And here it may be as well to mention that I am indebted to Mr. Markham's well-known work for the general history of the plant, and that in the account of cinchona-planting in India I have been entirely guided by the Blue Book on cinchona cultivation, published last August by order of Parliament.

Medicines, like religions, seem seldom to have been accepted in the countries of their birth. The religion which has the greatest number of adherents was born in one country, and accepted in another; and this is equally true of the religion which, secondly, has the greatest number of followers. And, curiously enough, the greatest drug in the world seems to have shared the same fate. All this, of course, may be merely an accidental coincidence, but it seems to me that it is just possible that the saying, "No man is a prophet in his own country," may be extended to plants. But, however all that may be, it is certain that though the Indians of South America were aware of the properties of bark, or rather of the "bark of bark" (*quina-quina*), it was not accepted by them; and the absence of this remedy in the wallets of the itinerant doctors who have plied their trade, from father to son, since the days of the Incas, seems to show that this medicine could never have been generally used. Surprising though this fact undoubtedly is, it is still more surprising to learn that the inhabitants of aguish districts should have a strong

repugnance to using this medicine at all. In the Peruvian province of Huanuco, where the people are much subject to tertian fever, their dislike to bark is particularly strong; and we are informed by Mr. Markham that "even in Guayaquil the prejudice against quinine is so strong, that, when a physician administers it, he is obliged to call it by another name." The existence of this singular prejudice seems to be clearly traced to the Indian theory of the cause of fever, which they always held to arise from inflammation of the blood; and just as our older physicians, acting from false reasoning, bled profusely for fevers, so the Indians thought they would at least refrain from adding fuel to the flame. They soon discovered that bark was very heating, and that was quite sufficient to deter them from using it in the treatment of a disease which seemed to them to require cooling drinks more than anything else. It would be interesting to learn whether this prejudice has since been overcome, and on this point I regret that I have no information to give. I may mention here that the natives in our part of India seem always to have known that the first, second, and third thing in fever is to keep up the bodily strength in order to aid the system in throwing off the disease—a fact that our physicians seem to have been ignorant of when bleeding was the rule for fever in India.

The whole genus of quinine-yielding trees was named by Linnæus *Cinchona*, and it may not be uninteresting to add that the name was given in honour of the Countess of Chinchon. The lady herself was of noble birth, and her husband, who took his title from the town of Chinchon, in the kingdom of Toledo, was appointed Viceroy of Peru in 1629. In 1638 the countess was

suffering from fever, and the Corregidor of Loxa, Don Juan Lopez de Canizares, sent a parcel of powdered quinquina bark to her physician, assuring him that it was a never-failing remedy for tertian fever. A complete cure was effected, and when the lady and her husband returned to Spain in 1640, she took with her a quantity of bark, and was thus the first to introduce this valuable medicine into Europe. Hence it was sometimes called Countess's bark and Countess's powder. The great family of *Cinchonaceæ*, it may be added, includes, together with cinchonæ, ipecacuanhas and coffees, and many other useful plants.

After this celebrated cure of the Countess of Chinchon, the further introduction of the bark was aided by the Jesuit missionaries, who penetrated far into the forests, and formed settlements on the upper waters of the Amazon. In 1670 these Jesuit missionaries sent parcels of the powdered bark to Rome, and from thence it was distributed to members of the fraternity throughout Europe by the Cardinal de Lugo, and used for the cure of ague with great success. Hence the origin of the names "Jesuit's bark" and "Cardinal's bark,"—names which, in those dark days, seem to have retarded its use amongst Protestants. It is difficult, in our days, to believe that this could really have been the case, and that Protestants should have rejected a valuable medicine on account of the name attached to it; but it seems difficult to escape from the conclusion that this consideration must have had some weight, and that it no doubt aided in strengthening the very strong prejudice against this medicine in European countries. In spite of all opposition, however, the new medicine steadily made way, and the second Lord Shaftesbury, who died in 1699, mentioned in one

of his letters that all the ingenious and able doctors treated fever with the Peruvian bark, though it was still the bugbear of the inferior physicians. But the controversy as regards the value of this medicine went on for some time longer, and as late as 1714 we find two Italian doctors writing vehemently for and against the use of bark.

The first attempt to transplant the cinchona from its native home was in 1743, when La Condamine visited Loxa, and stayed for some time at Malacotas with a Spaniard, whose chief source of income was the collection of bark. La Condamine obtained some young plants, with the intention of taking them to Paris, but he only succeeded in getting them as far as the mouth of the Amazon, when a wave washed over his little vessel, and carried off the box in which he had preserved the plants for more than eight months, and which he had already transported more than twelve hundred leagues on its journey. La Condamine returned to Europe, but Joseph de Jussieu, the botanist, who had accompanied him to America, remained behind, and continued for many years his botanical researches. But the fate of his laborious efforts seems still more melancholy than that of his associate, and we read that, after fifteen years' work, the botanist was robbed of his large collection of plants by a servant at Buenos Ayres, who believed that the boxes contained money. The loss drove the unfortunate botanist mad, and, entirely deprived of reason, he returned to France in 1771, after an absence of thirty-four years.

It is a melancholy business, pursuing the history of those failures which for so many years seemed to be the only reward of the men who toiled in those inter-

minable forests; but their very failures add not a little to the satisfaction of having ultimately reached complete success, and the reader must bear with me a little longer while I briefly describe the results of the next expedition to the cinchona forests of South America.

In 1776 the Spanish Government organised a botanical expedition to explore the cinchona forests of Peru. The members of this expedition were the botanists, Don José Pavon, Don Hipolito Ruiz, the Frenchman Dombey, and two artists, named Branete and Galvez. They embarked at Cadiz on the 4th of November, 1777, and reached Callao in the month of April. They made a considerable collection of dried specimens in the forests of Lima, and despatched them to Spain. They then crossed the Andes, explored the forests of Tarma, and proceeded to Huanuco. They succeeded in discovering no less than seven species of the cinchona-tree, and returned to Lima with the precious fruits of their expedition. They then made another botanical exploration in Chili, and, after returning to Lima, sent off their collection in fifty-three boxes, which were all lost off the coast of Portugal in 1786. Ruiz and Pavon then returned to Huanuco, but both fire and water seemed to war against the unfortunate botanists, and we read that subsequently a fire broke out in their house, which destroyed all their journals and collections. The botanists eventually returned to Spain, though I cannot find that they either brought plants or seeds with them; but, if they took the latter, we have no account of any attempt at rearing plants from them.

After these unsatisfactory expeditions, it is pleasant to read of something more cheering; and, in a scientific expedition sent out by Louis Philippe to America in

1845, we find at last the commencement of success. The botanist of the expedition was the talented Dr. Weddell, and he succeeded in bringing to Paris seeds of the *C. Calisaya* species, which were raised in the Jardin des Plantes in 1848. Others were raised in the garden of the Horticultural Society in London, where one of the plants flowered. Many of these plants were given away, and some of them were sent by the Dutch Government to Java.

We now come to the first attempt made to naturalise the cinchona, and it is much to the credit of the Dutch that they were the first people to appreciate practically the advantages of forming plantations of this invaluable tree. In Java are many forest-covered mountains, and it was on these that the Dutch determined to establish the cinchona. In 1852, accordingly, M. Justus Charles Hasskarl, a botanist, who had for some time superintended the gardens in Java, was despatched to America, with instructions to collect seeds and plants of as many species of cinchonæ as possible. We need not, of course, follow Hasskarl in his wanderings about the forests of South America, and it is sufficient to state that he eventually reached Java, with a number of plants of the *C. Calisaya* species, all of which, however, with the exception of two, have since died. With these plants he unfortunately brought with him the seeds of a species which he called *C. ovata*, and which has since been termed *C. Pahudiana*—a kind of cinchona that is almost entirely worthless. About the same time a plant of *C. Calisaya* arrived from Paris, and, with the aid of seeds from other sources, the experimental cultivation was fairly set going at the close of 1854. The Dutch, however, seem to have been unfortunate through-

out. In the first place, they started their plantation on forest land which appeared to consist of the finest soil; but it seems that, at the depth of six inches, there was a layer of sand and small stones, through which the roots could not penetrate. In consequence of this the plants languished, and the general result was that, after eighteen months, there were only three hundred cinchona-plants in Java, and these were in an unpromising, sickly condition. In 1856 a new system was introduced, and a new establishment started, with officials whose salaries in the aggregate amounted to no less than £3,256 a year. This time it is probable that success would have been certain, had it not been for that unlucky species, *C. Pahudiana*,* which was introduced by Hasskarl. The Dutch, finding that this was a hardy plant, and easily propagated, spent large sums in growing this worthless species, and neglected the more delicate and valuable *C. Calisaya*. The general result of all this was, that after three years the Dutch gardeners had only forty plants of valuable species in Java, and after six years they had only increased their stock to seven thousand plants.; while in 1861 the numbers of the worthless species alluded to amounted to millions. In India, as will be shown hereafter, we obtained far more satisfactory results, in eighteen months after the introduction of the plants, than the Dutch did after six years of expensive and laborious efforts.

It is time now to turn the attention of the reader to the introduction of cinchona-plants into India, and to

* Mr. McIvor thinks that "*C. Pahudiana*, although yielding in its wild state bark worthless in commerce, promises under cultivation to become of some value, though unlikely to enter into competition with any of the" (alluding to the valuable bark) "foregoing species."

the results of the experience so carefully and laboriously acquired by the able men to whom the introduction, growth, and general study of the plant have been intrusted.

Though the Government in India talked of the obvious advantages of introducing the cinchona into India as early as 1852, no serious step was taken till the year 1859, when the services of Mr. C. Markham were accepted by the then Secretary of State for India, who authorised that gentleman to undertake the entire task of the collection of plants and seeds in America, as well as their introduction into India. The arrangements were fortunately left entirely to Mr. Markham, and he was therefore at liberty to carry out the scheme without any further reference to Government. And truly there never was an occasion that more urgently required the energetic action of an active mind. The people of South America were well aware of the value of the monopoly they enjoyed; sooner or later their narrow-minded jealousy was sure to be awakened; and it was, therefore, necessary to act with despatch, and march simultaneously on all the forests which contained the most valuable species of cinchona. How this was done, and done effectually, the reader will find described at length in the interesting work entitled "Travels in Peru and India;" and, in the short space I have allotted for a description of the introduction into India of this important plant, I can but indicate the leading points of this great undertaking. Mr. Markham's arrangements were soon completed. He secured the services of Mr. Spruce—an excellent botanist and an intrepid explorer —for the cinchona forests of Ecuador, which is the country of the "red bark," containing in especial the

C. succirubra, which at that time was the species thought to contain the largest per-centage of febrifuge alkaloids. For the forests of the Peruvian province of Huanuco the services of Mr. Pritchett—a gentleman who had passed some years in South America—were secured, and he was in especial to collect plants and seeds of the species yielding grey bark; while Mr. Markham undertook to explore in person the forests either of Caravaya or Bolivia, and to collect the *C. Calisaya*, and other important species of that more distant region. Two practical gardeners also were engaged to attend to the packing of the plants in the forest, their establishment in Wardian cases, and to look after the plants on their voyage to India. On the 17th of December, 1859, the expedition left England, and towards the close of the month following arrived at Lima, the capital of Peru. After a month's stay Mr. Markham and his party sailed for Islay, a port considerably to the south of Lima, and the most conveniently situated as a starting-point for a journey to the cinchona forests of Southern Peru and Bolivia.

We will now, as briefly as possible, follow Mr. Markham in his journey into the cinchona forests of the province of Caravaya. The space will not admit of even a passing allusion to the many interesting points of the journey from Islay to Caravaya, and we must merely content ourselves with stating, in fact, that Mr. Markham reached Crucero, the capital of the province, and left that town for Sandia (the nearest point to the forests) on the 18th of April. At Acco-kunka (neck of sand), a place that merely consisted of one hut, Mr. Markham fell in with a red-faced man, of about fifty years of age, who called himself Don Manuel

Martel, and who was then engaged in clearing forest for sugar-cane planting. He had, it appeared, lost much money in the bark trade; and, alluding to the fact of plants having been taken out of the country by M. Hasskarl, the Dutch agent from Java, he took the opportunity of adding that, if ever people attempted to do such a thing again, he would stir up the natives to cut their feet off. This seemed to be merely a piece of bluster; but two days after his arrival at Sandia, Mr. Markham found that the man with the red face had already commenced operations by writing to several of the inhabitants of the place, and urging them to prevent the removal of either seeds or plants from the country. There was now clearly no time to lose; and Mr. Markham, getting together a month's supplies, soon started for the forests, with Mr. Weir, the gardener, and a few Indians, one of whom fled the first day. Subsequently, and before plunging into the forest of Tambopata, Mr. Markham was fortunate enough to secure the services of an experienced bark-gatherer, who had acted as guide to Dr. Weddell on the occasion of his visit to the Valley of Tambopata in 1846. The party, now consisting of seven, including Mr. Markham and the gardener, plunged into the forest on the 1st of May, and camped out night after night for a fortnight, during which time they were actively engaged in collecting plants of various species of cinchonæ. Struggling through the matted jungle, torn with thorns, stung by hornets, and tormented by insects of various kinds, the party spent many days of the severest labour in their arduous search. One of the most dangerous and toilsome days is thus described by Mr. Markham:—"The whole way," he writes, "was along giddy precipices, seeming to hang half-way be-

tween the sky and the roaring torrent, with no foot-hold but decaying leaves, nothing to grasp but rotten branches; every motion a drenching bath from wet leaves; every other step a painful and dangerous slip or fall; besides hornets and endless thorns." Amongst such difficulties as these were the parents of the plants now flourishing on our Indian hills brought from their native homes; and the only addition to this combination of annoyances that I can conceive would have been the presence of our Indian jungle leeches, which penetrate right through ordinary stockings, and often leave a nasty, irritating sore behind them. But every difficulty was gallantly overcome; and, without entering into further details, I must content myself with saying that Mr. Markham returned to Sandia on the 15th of May, with no less than five hundred and twenty-nine plants. Here, however, the most serious risks had to be encountered. Orders had been issued by the Alcalde Municipal of Quiaca for the apprehension of the party and the destruction of the plants; and there was nothing for it but an immediate flight, and the adoption of a compass course over the Cordilleras from Sandia to Vilque, in order to avoid entering town or village on the way. In their journey all manner of hardships, as well as both cold and hunger, had to be encountered; but every difficulty was eventually overcome, and the plants were safely deposited at the port of Islay on the 1st of June. Even here some further risks had to be incurred. It was with difficulty that an order was obtained to allow of the exportation of the plants; and, during the night before embarkation, an attempt was made to bribe the man in charge to bore holes in the cases, and kill the plants by pouring in boiling water. On the 24th of June, how-

ever, the plants were safely lodged on board the steamer, and started on the long road to India.

Space will not admit of my even alluding, however briefly, to the doings of Mr. Markham's colleagues; and it is sufficient to say that the whole party were more or less successful in procuring seed and plants. A large number of plants, of course, perished during the long route *viâ* Southampton and the Red Sea to India (the route by which the great bulk of the collections were despatched); but, in spite of every loss, a sufficient number of plants arrived safely in India to establish successfully this important cultivation. But, as Mr. Markham justly observes, the wonder is that any plants should have survived at all, through so many changes of climate and temperature. There was the long journey from the Andes to the coast, the risk of crossing the Isthmus of Panama, of changing steamers at the island of St. Thomas, at Southampton, at Suez, and at Bombay, and of the journey through Egypt. But all these difficulties were fortunately overcome, and, by the spring of 1861, a large supply of plants and young seedlings was established on the Neilgherry Hills, in Southern India.

I have now a rather troublesome task before me, and one that I have the greatest doubts as to my ability to perform in a sufficiently satisfactory manner. The task is that of boiling down a tremendous Blue Book which lies before me, of no less than 285 pages, and containing "Copy of all Correspondence relating to the Cultivation of Cinchona Plants, from April, 1866, to April, 1870." I feel myself burdened with the very wealth of *matériel*; and assuredly no one ever had less occasion to make up a book with what is vulgarly but expressively called

"printers' fat" (wide lines and much margin). My principal fear, however, is, that I may, from inadvertence, be the means of conveying incorrect information; and I should recommend any one who is practically interested in cinchonas to consult the Blue Book for himself. With this preliminary caution, I shall now endeavour to marshal before the reader, in the best order I can, the leading facts contained in the Blue Book in question.

The correspondence opens, curiously enough, with a letter to the Government of Madras from the Secretary of State for India, requesting that a supply of seed may be sent to England for transmission to the Emperor of Mexico; and I think this fact worth mentioning, just to show the widespread interest that is being taken in the propagation of cinchonæ.

The next letter is also from the same to the same, and lays down very clearly the principal object to be held steadily in view. The Secretary of State for India observed, in the letter in question, that it was gratifying to observe the readiness with which European and native planters undertook (in many cases in connection with coffee plantations) the cultivation of cinchonæ; but he was very justly of opinion that "the greatest benefit would be secured, should it be found practicable to promote the cultivation of the tree by villagers and small holders of land in suitable situations, even if they should not be able to do more than plant a few trees around their houses." This was very clearly seen to be the key of the position; and though I alluded to the subject at the commencement of the chapter, I think it one of sufficient importance to run the risk of wearying the reader by again calling his attention to the fatal flaw in

the introduction of cinchonas. When I last alluded to the subject, I suggested that the villagers should be forced to raise the plants. To the English reader this may seem an extraordinary proposition; and he will naturally ask what difficulty there can be in getting the Indians to put them down, if they know the advantages of doing so. But they do not know; and, as has been frequently pointed out in this book, there is no means in India of diffusing information on any subject (unless it be for the payment of a new tax) amongst the rural classes. In the absence, then, of the means of diffusing information, the Government must either abandon the idea of introducing the cinchona in a manner which would be of the greatest benefit to the people, or they must do what was done in Scotland in old times as regards ash-trees, viz., compel each man to put down seven plants in his garden. But it is time now to resume our researches in the Blue Book.

The plants and seedlings established on the Neilgherry Hills in the spring of 1861 were placed under the charge of the Superintendent of the Botanical Gardens, Mr. McIvor, a gentleman of unusual energy and ability; and it seems to have been universally acknowledged that, as regards the establishment and propagation of the plant in India, his name stands quite alone. He was the first, I believe, to adopt the system of propagation by buds, which seems to have been unknown to the Dutch, who depended entirely on cuttings and seeds. When I visited the hills in 1865, I made the acquaintance of Mr. McIvor, and had every opportunity of observing this system of propagation, which requires great care and nicety, as the young rootlets of the cinchona are extremely liable to rot if at all over-supplied with water.

The buds were, first of all, rooted in brickdust, with the smallest proportion of vegetable mould, and, after they had rooted, were transplanted into stronger soil. When each plant had made three pairs of leaves, one or two pairs were removed to grow fresh plants from; and in this way the propagation was carried on with extraordinary rapidity. This process requires now only to be carried out with a few of the rarer species, as an ample supply of seed is available from trees growing on the hills.

The establishment of the cultivation having been thoroughly effected, the Government, towards the close of 1866, sent out Mr. Broughton, an experienced analytical chemist. It was this gentleman's task to investigate every point connected with the plate: to analyse the bark of different species, to ascertain the climates and elevations most advantageous for producing the greatest amount of alkaloids, and especially to ascertain the preparation of febrifuge which would combine cheapness with efficacy in the greatest degree. Mr. Broughton was to act in concert with Mr. McIvor (who had been for some time officially called Superintendent of Cinchona Cultivation), and to take up his residence on the hills. To Mr. Broughton's observations we shall have frequent occasion to allude in the course of this chapter.

By far the most interesting and important discovery, as regards the bark of the cinchona, was made by Mr. McIvor. In planting out the cinchona-plants permanently, it had been found advisable to give them a support, to prevent their being injuriously affected by the wind. For this purpose, each plant or young tree was tied to a stake firmly driven into the ground. To

prevent the bark being injured by chafing, clumps or patches of moss were placed between the tie and the tree. In the spring of 1863, Mr. McIvor observed (he does not tell us how his attention came to be drawn to the fact) that the deposit of alkaloids was invariably most abundant in the bark covered by the lumps of moss.* In the bark above the clumps of moss the alkaloids were deficient, and immediately below the moss they were also deficient. This interesting fact led to close and continued observation; and, without going into details, which the reader can find in Mr. McIvor's Reports, it was established that there was a never-ceasing quinine-producing power in the leaves; that, through the agency of the sap, the alkaloids were deposited in the bark; and that from the surface of the bark there was continual oxidation or waste of its valuable constituents.† To protect, therefore, the alkaloids from this waste, it is necessary to exclude the action of light and air from the bark if you want to secure the whole advantage of the producing process. This important discovery at once upset all the notions previously entertained as to the advisability of getting in a bark harvest from loppings and prunings, which, by cutting off leaves, would necessarily injure the quinine-producing powers of the tree.

Experiments as regards what is now called "mossing" were carefully carried out; and it has since been established that, by taking off alternate longitudinal slips, one-half of the bark may be removed without the

* Mr. Howard observes that "this was practised to some extent in the old times of collection of the Loja bark, as described by Ruiz in a manuscript in the British Museum, under the name of *Cascarillas resacadas*."

† Mr. Broughton, as will be seen further on, asserts that mossing cannot prevent oxidation.

slightest injury to the tree. The parts bared of bark must then be covered with moss, and, in the course of eighteen months or two years after the new bark has fully grown, the parts of the bark previously left may be removed, and a similar treatment be repeated. The increase of alkaloids under moss is certainly very surprising, and at page 50 of the Blue Book is said, by Mr. McIvor, to be no less than thirty times that obtainable from unprotected bark.

In the early part of 1866 Mr. C. Markham inspected the Wynaad district, the largest coffee-planting district in India, with the view of ascertaining its capabilities for cinchona-growing, and found that there were numerous sites where the plant could be grown with advantage. Some of the planters had fine healthy trees, and many had then ordered considerable numbers from the hills. "But," writes Mr. Markham, "although the extension of this cultivation on the estates of European planters is much to be desired, it is far more important that the natives of the district should be induced to open small cinchona gardens in every direction, and in great numbers. The people suffer fearfully from fever. The scourge has appeared exceptionally early this season, and I have myself witnessed its ravages, while I am assured that later in the year the scenes, even on the public roads, are loathsome and heart-rending." Mr. Markham, in his general remarks on Wynaad, gives a number of interesting particulars as to the district, and dwells at considerable length on the very bad state, or rather the want of roads, which so largely impedes the progress of European enterprise. I feel strongly tempted to make use here of some of his information; but, however interesting it might be, it would only tend to

distract the reader from the subject of the present chapter.

In continuing these remarks on cinchona-planting, I find it difficult to pursue as regular a treatment of the subject as I should like, and I shall therefore content myself with picking out the leading facts connected with cinchonas, without any attempt at exact sequence, but taking what can be found very much in the order presented in the Blue Book.

In Mr. Broughton's Preliminary Report on the cinchonas (page 116 of the Blue Book), he points out that a very marked difference exists in the habit of individual trees of the red-bark species, both as regards their colouring and appearance. This variation had been noticed by Mr. Markham, who suggested that the variations in the colouring and habit of the trees might probably be connected with differences in their yield of alkaloids. This led to a careful examination, and the correctness of the suggestion was verified by the fact that the bark of four trees of the red-bark species varied in total yield of alkaloids from 4·85 to 7·00. The result of this examination was very encouraging, and even the poorest of the four barks examined gave at least an equal yield to the best Ecuador red barks. An examination of the root bark of *C. succirubra* gave not less than 6·0 per cent. of alkaloids, but, from the thinness of the bark, the large per-centage (74 per cent.) of water, and the labour required to procure it, it was shown that no remunerative yield could be expected from this source. The leaves of this species were next examined, but though possessed of a bitter quality, which might perhaps be of some tonic value, there was no reason to think that any febrifuge alkaloids could be expected.

The results obtained from mossing the bark were next investigated by the quinologist, and, as regards the Crown bark, it was shown that this process, when only applied for six months, greatly increased the amount of alkaloids in the bark. It was then shown that the deleterious effect of light on the bark and alkaloids had been pointed out by Pasteur many years ago, and it was on this account that he had recommended shielding the bark from sunlight while drying. This fact was experimentally verified by Mr. Broughton, and it was at the same time pointed out that as mossing neither excludes air nor oxygen, the idea of the waste occurring from oxidation was erroneous. And, generally, the investigations of the quinologist led him to the conclusion that the waste of alkaloids occurred from the exposure of the living bark to direct sunlight.

In his Preliminary Report it was also shown that the bark, in the green condition, presented several advantages which facilitate its examination for alkaloids; that these are extracted with much greater ease from the fresh than from the dry and powdered bark; and that this property of the fresh bark would eventually become of considerable importance in the manufacture or preparation of the febrifuge principles existing in the bark.

The next paper claiming our attention is Mr. McIvor's Report for 1866-67, in which he shows that the progress made throughout was most satisfactory and encouraging in every way. The total number of plants propagated on the hills amounted, on the 1st of April, 1867, to no less than 1,926,044. The first plants, planted out in August and September, 1862, had reached heights varying from fifteen to twenty-two feet, and were producing many millions of seeds, and the seeds gathered the year

previous had germinated freely. Numbers of these seeds had been distributed, and the universal reports of their excellence showed that they must have been in the finest condition. The results, too, of the analysis of bark continued to be equally satisfactory, and it was shown that a steady increase of alkaloids had been obtained annually. Thus the barks submitted for analysis in the early part of June, 1863, gave 3·40 per cent. of alkaloids; those submitted in 1864 gave 6·0 per cent. The highest result attained from the samples of 1865 was 9·72 per cent. of alkaloids, while some of the samples yielded as much as 6 per cent. of crystallised sulphates. The bark submitted in October, 1866, for analysis gave 9·79 per cent. of alkaloids, and, of this, 8·45 crystallised sulphates, showing an increase of nearly 2·50 per cent. of crystallised sulphates in one year's growth; and these results were altogether unprecedented, even in the finest sample of mature American bark.

Turning next to the condition and growth of the plants, it was shown that it was very unadvisable to cut down the tree at an early stage of its growth, as the increase of growth and bark was much more marked after the tree had attained a certain age. Thus the growth of the trees in 1866-67 was such that the weight of bark was nearly doubled. The *C. succirubra* still maintained its robust habit and luxuriant growth, and showed itself to be the most profitable species to cultivate at elevations of from four thousand to six thousand feet. The *C. officinalis B. Condaminea* almost equals the *C. succirubra* in luxuriance of growth, and comes next in value to that species, while at high elevations (between six thousand and eight thousand feet) it is the most profitable plant to cultivate. With one or two exceptions,

all the varieties of *E. Calisaya*, or Bolivian bark, were found to be delicate, difficult to grow, and generally unsuited to the climate. The bark of the *C. Pahudiana* (the kind so largely grown by the Dutch in Java) had, within the last year, much improved in appearance and value; but Mr. Howard, in his Report, thinks it a pity to grow this species, though he considers that, where grown extensively, as in Java, it might be used in decoction. The *Cinchona lancifolia* received from Java promised to be a valuable species, and, though of slow growth, was observed to be hardy and suited to the climate; it also appeared to thrive as well upon grass as upon forest land.

As regards the cultivation of the plant, it was shown that all the cinchonas did far better in the open, and quite out of the shade of forest trees. The system of staking the plants had been discontinued, excepting where they were much exposed to the south-west monsoon gales. On inspecting private plantations, it was found that many fine trees had been destroyed by earth having been washed down and heaped about the stem, or from earth having been heaped against the tree when weeding. The result of this is that a fungus attacks the plant, and destroys fine plants of four or five years' growth in as many days.

In this Report the results obtained by private planters in the hills were also alluded to, and it was shown that though many individuals entered the field at first, a good many had found it necessary or advisable to sell out, or to relinquish the undertaking. Some planters, however, had made rapid strides with their cultivation, and there were about seven plantations in a very flourishing condition. Mr. McIvor attributes the fact of a decline in the cultivation to the monetary crisis and the

high land-tax, but the true reason probably was that people lost heart in continuing a cultivation the commercial success of which had not been practically proved. By the Report of the following year, however, it seems that the cultivation was gradually gaining ground; but, as no particulars are given, I conclude that the extension of cultivation must have been extremely small.

In Mr. McIvor's Report for 1867-68 the value of mossing was very conclusively shown by the fact that the bark of *C. Pahudiana* (a species hitherto considered quite worthless) had, under this process, increased in its yields of alkaloids from 0·761 to 2·21 during the year 1867. The public sales of bark in England during the same year had also given very satisfactory results, ranging higher than those obtained for the same description of American bark. A large extent of grass land had been brought into cultivation, and it was shown that *C. officinalis* grew quite as well as upon forest land, and that *C. succirubra*, though not yet quite as fairly tried as the former, bid fair to equal it. As Mr. McIvor observes, the fact of the two most valuable kinds growing on grass land opens up a wide field for capitalists, as the amount of grass land is enormous. This, no doubt, is true, but it remains to be seen whether the field be not rather too wide. It may be alleged that the demand for quinine is unlimited; but this, it must be remembered, has still to be proved. The demand, however, would no doubt always be very great, and it is encouraging to know (at least, so I was informed by a well-known mad-doctor some years ago) that quinine is now largely used for lunatics—a class of people the rapid increase of whom may be contemplated by cinchona-growers with a kind of melancholy satisfaction.

Towards the close of this Report there is a most interesting account of the progress made in the Botanical Gardens, and many of the introductions of recent years had begun to show fairly their character, and adaptability to the climate. Amongst those which grow vigorously, and are evidently well suited to the climate, may be noticed, as valuable economical plants, the *Exogonium purga* (jalap); *Convolvulus scammonia* (scammony); *Aralia papyrifera* (the rice-paper plant of China); and *Phormium tenax* (the New Zealand flax). The value of the jalap was shown by Mr. Broughton to be as great as when grown in its native country. The scammony, though growing freely, had not as yet been chemically tested. The New Zealand flax had grown most luxuriantly in every situation. Mr. McIvor, too, had recently brought out from England no less than eleven hundred plants of every kind that appeared to be of value, or likely to succeed in India. I need not, of course, enumerate any of these, but I may mention that the *Olea Europæa*, or true olive, has been introduced, both in its normal and variegated form. I may mention here that another very valuable plant, ipecacuanha, so useful in cases of dysentery, has been introduced both on the hills and plains. This plant fortunately seems to thrive equally well at the Neilgherries and at Calcutta; and I may add that Dr. John Murray has the credit of having directed the attention of Government to the subject.

But it is time now to resume our remarks on cinchonas, and the next paper claiming our attention is Mr. Broughton's Report of August 17th, 1868, which contains an account of the following important discovery. Amongst the Crown barks grown from seed brought by Mr. Cross were a few scattered trees which presented

a marked difference from their companions, and had leaves of a narrow lanceolate shape. On analysis, this variety showed an extraordinarily large proportion of alkaloids, and, on a comparison with the adjoining trees of *Cinchona officinalis*, it was found that the total alkaloids of this lanceolate species amounted to no less than 8·0 per cent., while the bark of the adjoining trees gave only 4·48. The yield of quinine obtained crystallised came to no less than 7·35 per cent., and Mr. Broughton is of opinion that, in yield of quinine, it is of the finest quality that has ever been recorded. Besides this, it possessed every characteristic constituting excellence. Specimens of this species were sent home to be botanically examined.

In this Report we have an estimate of the value of branch bark of *C. succirubra*, and it was found that it contained 1·91 per cent. at two and a half years old, and no less than 4·31 of alkaloids at three and a half years old. The branch bark, therefore, when young, is of considerable value.

We have also to notice some analyses of Coorg bark, and though they were made at a season of the year unfavourable to the produce of alkaloids, the three year and nine months' trunk bark of *C. succirubra* gave from 4·10 to 5 per cent. of alkaloids.* Some Wynaad bark was also analysed, and this analysis was of particular interest, as the elevation did not probably exceed two thousand four hundred feet. In this bark the total alkaloids came to 4·1, and the yield of quinine was 0·6; of cinchonidine and cinchonine 3·5. These analyses show that quinine is formed in much less quantities at low elevations; but, as Mr. Broughton observes, the

* Of these, however, we have quinine only to the amount of 0·81, cinchonidine 2·15, and cinchonine 2·70.

result cannot be considered unsatisfactory, since they contain a large amount of alkaloids, which recent trials have shown to equal quinine in febrifuge effect. This result is certainly very satisfactory, as it extends very largely the range at which this plant can be grown. It was found by the quinologist that the wood of *C. succirubra* contains an appreciable amount of alkaloids. The heart-wood was found to contain the most, amounting in alkaloids to from 0·08 to 0·11 per cent. of the weight of the dry wood. Mr. Broughton, though pointing out that the total alkaloids in the wood of a plantation must be very considerable, is of opinion that they could not be remuneratively extracted while so large a yield was obtainable from the bark.

Further on in the same Report we have analyses of Neilgherry bark at elevations varying from two thousand three hundred to seven thousand seven hundred and seventy feet, and the result showed that the idea of the greater elevation yielding more alkaloids is erroneous. The whole of Mr. Broughton's experience led to the conclusion that a high mean temperature is adverse to the yield of quinine, but not to that of cinchonidine, and the elevation of from six to seven thousand feet seemed to be most favourable to the yield of quinine. As this question of elevation is of obvious importance, I give in a table the results of Mr. Broughton's experiments.

	Ootacamund.			Neddiwuttum.			
	1	2	3	4	5	6	7
Red Barks	Feet. 7,770	Feet. 7,660	Feet. 7,450	Feet. 6,560	Feet. 5,450	Feet. 3,500	Feet. 2,300
Total Alkaloids	2·38	2·03	4·21	5·75	3·80	4·10	4·10
Quinine	0·45	0·33	0·70	2·50	1·20	0·86	0·60
Cinchonidine and Cinchonine	1·93	1·70	3·51	3·25	2·60	3·24	3·50
Crystalline Sulphates obtained	1·75	1·60	3·20	4·20	3·10	3·58	3·40

Mr. Broughton considers it worthy of remark, that "among the numerous analyses that have been made of red bark grown in climates whose mean temperature has ranged from that of Northern Italy to that of African Tunis, no sample has been met with that did not give a more or less satisfactory yield of febrifuge alkaloids, or in which quinine was not present."

In the Report under consideration the advantages of mossing are again alluded to; but it is pointed out that no means at present exist to show that a system of mossing would, or would not, pay better than other methods of cropping the bark, such as coppicing. The cause of the increase of alkaloids by mossing was further investigated, and two trees were covered, one with tinned plate, the other with black cloth, the object being to keep the bark in darkness, while access of air was not impeded. The result showed that the deprivation of sunshine did increase the amount of alkaloid in the bark, and the alkaloid was obtained crystallised with nearly the same readiness as in mossed bark. The amount of quinine was not, however, increased, as in the case of mossed bark, and for this fact no explanation could be given. It was also shown that the renewal of the bark is not the consequence of the covering with moss, though there was reason to suppose that the protection afforded by the latter undoubtedly facilitates the re-growth. An analysis was next given of naturally-renewed bark, and it was seen that the alkaloid of reforming bark is mainly quinine, though that of the original bark it replaces is in great part cinchonidine. This fact corroborates the statement concerning the practice of the American bark-gatherers, of partially stripping the bark off a branch, and allowing the bark

to grow again. In this Report of Mr. Broughton's there are many other interesting facts; but the space I have allotted to the subject does not admit of my mentioning anything that does not seem to be of immediately practical interest.

The next paper worthy of a passing mention is a letter from the Resident of Travancore, giving an account of the cultivation at Peermade, in that country. It is unnecessary to go into the details of this communication, which presents no new feature whatever; and the general result was, that the cultivation had turned out eminently successful.

In Mr. Broughton's next communication we have further reference to the lanceolate-leaved variety (or perhaps species), mentioned in his last Report as containing such a large amount of alkaloids. A search had since been made over the whole plantations for specimens of this variety, but no more than about a dozen could be found. The result of repeated analyses and examinations of the bark led Mr. Broughton to attach even a greater value to this kind than at first. A number of analyses are given in his Report. It was seen that the yield greatly exceeded that of the Crown barks growing under the same conditions; and in two instances the alkaloids consisted almost entirely of quinine. The amount, indeed, was quite unprecedented; and one of the barks examined gave threefold the yield of fine Bolivian Calisaya. But even this statement hardly gives an accurate idea of the value; for the alkaloid is contained in a third of the bulk of material, and the expenses for labour, carriage, and extracting the alkaloids are necessarily largely reduced. To clear up all doubts as to the value of this species, some bark

was sent to Mr. J. E. Howard, and the result of that gentleman's analysis was found closely to coincide with Mr. Broughton's. The importance of this discovery can hardly be overrated, and steps were at once taken for the rapid propagation of the new species.

In Mr. McIvor's Report for the year 1868-69 there is not much of practical interest to notice. Cinchona cultivation as a private speculation had received, it appears, a decided check; the value of estates had greatly fallen, and they had, indeed, become almost unsaleable. A number of seeds and plants had been sent to Burmah, and the cultivation in that country is reported to be progressing favourably. The root-bark of a *C. succirubra* tree seven years old had been sent to Mr. Howard for examination, but it turned out to be of much the same commercial value as other samples of the same bark (but of larger size) sent at the same time for analysis; and Mr. Howard thought that the root-bark of this species would not repay cultivation.

In this Report of Mr. McIvor's there is a very interesting account of the introduction and propagation of European fish, which I cannot resist alluding to; and I dare say that, after so much about cinchonas, the reader will have no objection to a temporary change of subject.

A quantity of young lake-trout fry was collected by Mr. McIvor in July, 1867, and the young fish were kept in an aquarium until their departure for India. In the aquarium they were taught to do with as little water as possible, and, on leaving England, eighteen of the most healthy were selected for a voyage to India. The other fish had not had this preparation, and this was believed to be a disadvantage. On the 3rd of November, 1867, Mr. McIvor left Southampton by the Peninsular

and Oriental Company's steamer, with eighteen lake-trout fry, twenty-four tench, twelve carp, twelve gudgeon, twelve rudd, twelve silver eels, and three gold-fish (one male and two females). Of these, fifteen trout, ten carp, twenty-four tench, twelve rudd, twelve silver eels, and three gold-fish reached the Neilgherries in safety. The gudgeon were all lost by an accident in the Red Sea, and two trout were lost by leaping out of the tubs in which they had been placed. One female gold-fish died; while nine of the eels escaped into the running stream, and have not since been seen. At the date of the Report the fish propagation had been going on for eighteen months with eminent success. The trout had spawned, and there were from two to three hundred young fry, from one to two inches in length; about the same number of young tench; three dozen young rudd; while the parent fish have grown to a large size. An interesting account is given of the method of carrying large fish to a distance; and this experiment of Mr. McIvor's is said to have been the first successful one of the kind. But space will not permit of my entering into further details on this most interesting subject.

The next letter on cinchonas that seems worthy of a passing remark is one from the sub-collector of Tinnevelly (south of the Neilgherries), who reports that a broad-leaved kind of cinchona (probably *C. succirubra*) is thriving in his district at as low an elevation as from one to two thousand feet; but no analysis of the bark is given.

In Mr. Broughton's Report of December 9th, 1869, he notices that though examinations of the *C. succirubra* bark show a total increase of alkaloids, the yield of quinine seems to decrease with the age of the tree. This dimi-

nution of quinine in the age does not obtain in *C. officinalis;* but no explanation is even suggested to account for this curious fact. It was also observed that the most vigorous and quickly-grown trees yielded a far richer bark than the more stunted ones of the same age, and the advantage of high cultivation was therefore very apparent. The leaves of various kinds were again carefully examined, and the quantity of alkaloid was shown to be too small to give the leaves any value as a febrifuge. The blossoms were also examined, but were found to contain no alkaloid. Their bitter taste is owing to quinovine, the principle which also gives the bitter taste to the leaves. The therapeutic effects of quinovine are under trial by the medical department. In this Report we have the pleasing assurance that, amongst the many barks examined from different parts of India, not one had failed to give a satisfactory result. The *C. succirubra* in especial seems to flourish everywhere; and it appears certain that, whenever the tree will grow at all, a satisfactory amount of alkaloids may be relied on.

In this Report we have also a number of experiments as to the various modes of drying the bark; and it was seen that drying the bark in the sun is injurious. This has been abundantly proved; but, to make the fact quite apparent, prolonged insolation is required, or else the exposure of the bark in a divided state, in order to have an increased surface of action. Under these circumstances, a decrease of a half per cent. in the amount of crystalline sulphates obtainable from the bark takes place. If shred bark be allowed to remain a fortnight exposed to the sun on the Neilgherries, the decrease amounts to one per cent. Under ordinary circumstances,

unless the exposure to sunlight be carelessly prolonged, the alteration in quality is practically imperceptible. The bark should, of course, be obtained in as large pieces as possible (to expose but a small surface), and be frequently turned, so as to dry it in as short a time as possible. By various interesting experiments it was also shown that the alkaloids when in the bark are very permanent substances, and extremely difficult of destruction. Even bark kept three months in a moist place, and allowed to heat to such an extent as to turn into merely a mouldering mass, gave no less than two-thirds of the original amount of alkaloids.

Experiments were next made as to the influence of the seasons on the amount of alkaloids, and it was shown that the period at which the bark is richest in alkaloids that yield the largest amount of crystalline sulphates is the month of May; but, taking into consideration the most convenient season for drying the bark, an opinion was expressed that the bark harvest might be gathered any time between November and May. In this Report there are many other interesting points discussed, which I have no space to do justice to. Amongst these are the remarks as to the condition upon which depends the amount of quinine in the cinchona barks, and the observations on the form in which the alkaloids occur in the living bark.

The attention of Government having been called to a native febrifuge existing in the bark of the large forest tree *Hymenodictyon excelsum*, Mr. Broughton was requested to investigate the subject; and in his letter or Report of June 6th, 1870, we have the results of his examinations. This tree, it appears, belongs to the same natural order as the true cinchona, and it so

greatly resembles that species in appearance that it was named for many years *Cinchona excelsa*. Being thus considered a cinchona indigenous to India, very considerable expectations were entertained that it would be found a most valuable febrifuge, if not an actual source of quinine. Some bark of the tree in question was accordingly procured, and, though bitter when fresh, was found to possess the remarkable property of losing this bitterness by keeping; and so much is this the case, that after a few days the bark becomes nearly tasteless. After much labour the bitter principle was obtained in a pure crystalline state, and a full examination showed that it was identical with æsculine, the fluorescent and crystalline principle of horse-chestnut bark. It is worthy of notice that the bark of the latter has obtained a reputation like the Hymenodictyon of India, and was considered by many as a good substitute for cinchona bark. But a full examination showed that the bark of *Hymenodictyon excelsum* differs entirely in its chemical character and products from cinchona bark; and, as the former contains no trace of quinine or related alkaloid, there seems to be little reason for supposing that it has much medicinal value. It seems to me that it would certainly have been interesting to have made a series of medical trials with æsculine; but Mr. Broughton seemed to think this scarcely necessary, as, whatever might be the effects of this remedy, it was certain eventually to be both dearer and scarcer than the cinchona alkaloids, and there could be no doubt as to its inferiority as a therapeutic agent. I may add that the loss of bitterness undergone by the bark on keeping was readily explained by the fact that æsculine in contact with decaying organic substances is decom-

posed, and produces æsculetine, a comparatively insoluble substance, with only a slight bitter taste.

The history of cinchona-planting in Bengal contains few features of particular interest, and may be said to be exactly a repetition of what was carried out so successfully in the South. In Dr. Anderson's first Report, however, it seems worthy of notice that plants of *C. succirubra* had been found to thrive at as low an elevation as three hundred and fifty feet above the level of the sea. Mr. J. E. Howard examined samples of the Darjeeling barks, and saw no reason to think them at all inferior to those grown on the Neilgherries. He also observed that the difference of climate seemed to have little effect on the alkaloid contained in North Indian bark.

The cultivation of the cinchona by companies and private individuals seems to have made far more progress in North India than in the South; and I observe, by Dr. Clarke's Report of May 27th, 1869, that the Darjeeling Cinchona Association possessed on April 1st, 1869, no less than 671,518 plants, of which 652,506 were of the *C. succirubra* species; the area planted was 275 acres; and the Association was pushing on the cultivation with great rapidity. Without particularising further, it may be added that in the Darjeeling district there were in private plantations 795,518 plants, while Government plantations contained 2,232,532.

In Dr. Clarke's Report of April 29th, 1870, he mentions that, as an experiment, a small portion of the denser portion of one of the plantations was thinned by cutting down three trees out of every four. This was found to produce 300lbs. of dried bark, worth about £25 an acre. At the same time, a considerable portion

of the more advanced trees were pruned by the removal of the lower branches. There were stored, we are told, from the thinnings and prunings, in all, 2,400lbs. of dried bark. It will be observed that no practical conclusion can be drawn from these statements. The age of the trees is not stated, nor the method of ascertaining the value of the bark; and it is not clearly stated whether the prunings of lower branches of advanced trees were from those left on the land that had been thinned, or whether they were obtained from older trees in other parts of the plantation. My only object, then, in mentioning this statement at all is to suggest that, in future, it would be advisable to present such statements in a form showing the practical results and profits of the undertaking, with the view of enabling private individuals to form some notion as to the results likely to be obtained from embarking capital in cinchona cultivation.

We have now almost got to the end of the Blue Book, and it only remains to notice a Report which, though last, is by no means least in importance. This is the Report of the Bombay Cinchona Commission, which had been appointed to estimate the value of the alkaloids, other than quinine, existing in cinchona bark. It had long been known that four alkaloids existed in bark,—quinine, cinchonine, quinidine, and cinchonidine; but the last three were all held to be of far inferior value as febrifuge agents; and the general reader has probably never heard of any other principle than the quinine of bark being of the slightest importance. The Government was naturally desirous of testing practically the value of all the alkaloids other than quinine; and accordingly commissions were appointed, both in Bombay

and Madras, to investigate the subject on the largest scale. The results were naturally looked for with some anxiety, as many barks are rich in cinchonine and cinchonidine that contain but little quinine; and, as has been seen by the examination of Coorg and other barks, cinchonas grown at inferior elevations yield but a small proportion of quinine. The Bombay Committee, after having tested the efficiency of the alkaloids on a scale sufficiently extensive to secure decisive results, gave in their conclusions as follows:—They pronounced the general effects of the alkaloids under consideration to be similar to those of quinine, though perhaps in an inferior degree, and found that they were very efficacious in treating the common fever of the country. The relative value of the four alkaloids seemed to be—1st, quinine; 2nd, quinidine; while cinchonidine and cinchonine seemed to be about equal. Their proper doses were held to be,—quinine from 3 to 10 grains, quinidine from 5 to 20, and the other two from 7 to 20 grains.

The Report of the Madras Commission was even more satisfactory, and Dr. Chipperfield was led to form a high opinion of quinidine, which he considered to be quite as valuable as the disulphate of quinine itself. In some respects it seemed to him superior to quinine, as in no instance did it produce any of the disagreeable effects termed "cinchonism;" in fact, two patients who were suffering from severe headache, stated that the medicine completely relieved this symptom: 1,145 cases of paroxysmal fever were treated with these alkaloids, and the unanimous conclusion was, that they were scarcely, if at all, inferior to quinine, any difference being of degree rather than of kind.

In the Report on the administration of Mysore for 1868-69 the cinchona plantation on the Bábábudan Hills is said to be succeeding well. It contained, at the time of the Report, six thousand plants of *C. succirubra* in flourishing condition; but the Condaminea and Calisaya plants were reported to have a sickly appearance. The whole of the western border counties seem suitable to the growth of cinchona. I was, I believe, the first person to introduce the plant into Mysore, which I did from the Neilgherries in 1865, when I sent to my estate about two hundred plants. Of these only about twenty survived, some of which were tried in the lowest and wettest parts of our district, and others in the higher and driest parts. Those on the drier estate, which lay, of course, in the most easterly part of the county, though not presenting at all a sickly appearance, did not look very vigorous; but the few plants put down in the most westerly and wet part of the county seemed to me as luxuriant as any I saw on the Neilgherries. I did not, however, continue the experiment, nor was any particular care taken of the plants. None of the bark has been analysed, but some was shown to Mr. Howard, who considered it to have an unpromising appearance. The experiments of Mr. Broughton, however, have shown that wherever the red bark (*C. succirubra*) grows the return is invariably satisfactory, and, in some shape or other, furnishes valuable alkaloids; so that I conceive no analysis is required to enable me to assert that the cinchona can be grown with advantage all along the western frontier of Mysore. The exact value of the bark, of course, remains to be seen; but, with our knowledge of the yields at the various elevations, a fairly approximate conclusion can readily be arrived at; and

there is no reason to think that the yield obtained from bark in Coorg (4·10 to 5 per cent. of alkaloids) would not be equalled all along the western border of Mysore.

I have said that cinchonas could be grown with advantage all along the western border of Mysore, but I must caution the reader against concluding that I mean to offer an opinion favourable to cinchona cultivation taken by itself. This cultivation has not, that I am aware of, ever been proved to be successful in a financial point of view; nor do I conceive that a sufficient time has elapsed since its introduction to enable any one to pronounce decidedly and confidently on the subject. But I think it may very safely be asserted that all owners of coffee plantations should put down trees wherever they can conveniently find room for them; and it is certain that they could be advantageously used as shade for coffee, though, in the last instance, the bark would have to be cautiously removed by the system of mossing introduced by Mr. McIvor on the Neilgherry Hills.

We must now say good-bye to this most interesting subject. But I find it impossible, in conclusion, to refrain from remarking on the wonderful and unbroken success which has attended all that has been attempted as regards the introduction of the cinchona into India. The whole scheme has been carried out in a way which reflects the greatest credit on the Government, and on all the gentlemen employed to carry its wishes into execution. The plant has not only been taken from America to India, and firmly established there, but every fact connected with its growth, and with the valuable remedies contained in the bark, has been carefully, and I may even say elaborately, investigated.

But though the Government has succeeded in all it has seriously attempted, there is one point which it has not attempted, and where it has been weak enough to content itself with the expression of a few feeble wishes. The Government has said that "it is much to be desired that natives in feverish districts should put down at least a few plants around their houses." It ought to have said plainly to the natives, "You must put down a few plants around your houses." It has not said this, and, until it does say it, it is certain that the large sums taken from the Indian tax-payers to introduce this important plant can never benefit the generation that has paid them.

NOTE.—I observe that (*Agricultural Gazette* of India, p. 103) the colouring matter in the red barks is likely to make a good substitute for indigo.

CHAPTER XII.

CARDAMOM-PLANTING.

It is a serious thing to say much in favour of a comparatively new and untried cultivation, and, as I should be sorry to be the means of leading any one into a speculation which may turn out to be a failure, I deem it of importance to lay before the reader all the evidence and reasons I have for supposing that the cultivation of cardamoms is likely to prove a solid and lasting source of profit. But though the reasons may seem as conclusive to the reader as they do to me, it must be considered that there are probably weak points which have either escaped my observation, or which would only become apparent in going into the cultivation on a large scale. Any one, then, who thinks of embarking capital in this cultivation should merely consider what I have to say as in all probability fairly accurate as far as it goes, but requiring a great deal of further experience to confirm it thoroughly. And as to the cultivation of the plant itself, the remarks I have to offer, or that I may have gleaned from others, must only be considered to be a basis leading to better modes of cultivation which must, sooner or later, be discovered. With these general cautions, I shall now proceed to lay before the reader a full account of the demand for, and consumption

of, this seed, and the best-known methods of cultivating it.

And here I deem it of most importance to go into the question of demand and consumption first of all, reserving a description of the plant for that part of the chapter which treats of its cultivation.

To people in England who have ever required a medical prescription the word "cardamom" will not be suggestive of very agreeable reflections, for its principal use in this country is to disguise the flavour of nauseous drugs, and, in the shape of tincture of cardamoms, it is used, I believe, pretty extensively by physicians. It is used, besides, as a spice, and is often employed in confectionery. On the Continent it is much used for that purpose, and especially in Germany. It is also used to flavour Hollands. Up to this point it is plain that not much can be said in favour of cultivating the plant; but when we turn to its use in Eastern countries, and in European Turkey, we shall find an almost unlimited demand for this spice, for in almost all Eastern countries it is used as the most favourite of spices, and there seems to be hardly a dish in use amongst Asiatics where cardamoms do not appear. As regards Oriental cookery, I have only been able to meet with one book, or rather translation of a book, written by a native of India, and the author's preface to which is as follows:—

"He who facilitates.

"In the name of God, the peculiarly merciful and gracious.

"Treatise in explanation of delicious foods and meats.

"Let it be known to the whole community who are intelligent, and who have a taste for learning and the

arts, that whereas the excellent dispositions of the gallant Captain Paxon (may God perfect his nature!), a gentleman of high dignity, an appreciator of learning, skilled in the rules of India, qualified to estimate the sciences of Arabia and Persia, of high repute and full of intelligence, is much inclined towards the meats of India and its delightful dishes; therefore, with the approbation of that gentleman, some kinds of fine dishes are herein described in a brief manner."

Then follow a number of receipts for particular kinds of dishes, hardly one of which is without cardamoms in some shape or other. In fact, they seemed to recur as regularly as the drug does in our medical prescriptions.

Besides this, cardamoms are also used for chewing with betel by all natives who can afford them, and as this combination of areca-nut, lime, and pepper-leaves (all of which, being mixed up together, enable a man to chew betel), is universally used, it seems pretty evident that it would be difficult to overstock the Eastern market with this spice. But, in addition to this reasoning, I think it desirable to lay before the reader some further evidence on the subject, and I may mention, accordingly, that I was informed by a native merchant in Madras that almost any quantity of this spice could readily be disposed of. I may also mention that being anxious to have the best information on the subject, I wrote to Mr. Crake, one of the partners in the well-known firm of Messrs. Crawford, Colvin, & Co., London. This gentleman had been many years in business at Madras, and I do not think it would be possible to furnish the reader with a better practical opinion as regards the probable demand for cardamoms. In answer to my inquiries on the subject

Mr. Crake supplied me with the following information, which I think it advisable to give in his own words:—

"Cardamoms in this country, and in Europe generally, are used as condiments only in *small* quantities. They are chiefly required as a pungent powerful flavour by the druggists, who make free use of them in their concoctions to disguise other and less pleasant ones. This is not so in Oriental countries, where cardamoms enter very largely into the cookery of both Hindoos and Mussulmans, and, as your Madras informant told you, there is almost an UNLIMITED field for their consumption in Eastern countries, and also in European Turkey. It is this, so to say, native demand, that is the real back-stay of the value of cardamoms; and when prices in England for a series of years were unremunerative, the import of all FIRST-CLASS cardamoms declined until prices reacted, and last year, as you are aware, reached a high point. This is still so, just at present, but once satisfy the home demand, and I think the level of prices will be established rather by the Eastern than the European markets."

Having thus seen that there is such a fair field for selling the cardamoms, and taking into consideration that, as will be shown further on, they are so easily and cheaply grown, it seems natural to inquire how it is that the cultivation of this spice has been so long neglected by Europeans. And here I find it impossible to answer this question in any very satisfactory way, except that the planters in the cardamom districts seem to have turned their attention almost, if not quite, exclusively to coffee, and have probably had neither labour nor time to attend to anything else. But, besides this consideration, there was another which influenced me, and I have no doubt largely influenced others, and that was the idea prevail-

ing that cardamoms were used in such small quantities that a very slight increase in the supply would soon bring prices down to a losing point. Nor was there any information before the public to show the extent of the demand existing, or the prospect of its increasing to any considerable degree; and it was not until chance turned my attention to the subject that I thought it worth while to collect such information as could be obtained. But there is such a natural disinclination to venture on the unknown, and such a number of prudential considerations in favour of letting some one purchase experience for you, that I do not think I should have cared to take to the cultivation of cardamoms had it not been that I once took up forest land for planting coffee in a situation that was at once too wet and too hot, and which, besides, seemed to have something wanting in the soil that coffee required, notwithstanding that the forest itself was, as regards growth of timber, one of the finest I ever saw. But, however all that may be, I lost my money, and there was nothing left but to see what could be made out of the wreck; and I accordingly turned my attention to the indigenous products of the land, or rather, the only indigenous product out of which it seemed that anything was likely to be got. I consequently instructed my manager to transplant a number of the cardamom-plant bulbs, to place them under the most favourable circumstances, and to estimate carefully the expenses incurred, in order to see whether it would really pay to go into the cultivation. The experiment was accordingly made, and, without troubling the reader with details, I may mention that the result was so satisfactory, that I have ordered as much land to be got ready this season as we can conveniently find plants for. And, as regards the

cultivation, there is one very striking advantage it has over any other I know of, and that is that no expensive buildings and no machinery are required; and, besides that, the cultivation is such that, in the event of prices declining, you might entirely abandon the property without the slightest harm being done to the plants. In fact, to let the land lie fallow for a time, and to reduce the produce thereby to a minimum, would be rather an advantage than otherwise, and, when prices again reacted, the active cultivation of the plant might be resumed. I have said that neither buildings of any extent nor machinery of any sort would be required on a cardamom plantation; but it must also be borne in mind that no preparation on the coast is required at all, as in the case of coffee, which has to be got ready for market by agents on the coast, at the rate of 5*s.* per cwt. And, further, the transport expenses fall extremely lightly on this spice. A pound of cardamoms costs, for inland carriage, little more than a pound of coffee, while the value of the spice is at least from five to six times the value of coffee, and, in some instances, rises to no less than eight times the value.* So that, when we take all these advantages into consideration, it seems pretty evident that cardamom cultivation has immense advantages over every kind of cultivation that has ever been undertaken by Europeans in India; and as nothing has, I believe, been ever published on the subject, I shall make no apology for giving, at considerable length, all the information I have been able to collect. I have said that nothing has ever been published on the subject, but by the term "publish" I do not mean to say that

* I may mention that I last year sold some cardamoms, the produce of my land, at 8*s.* 7*d.* per lb. The quantity, however, was small.

nothing has ever been printed on cardamom cultivation, for a very interesting Memorandum by Edgar Ludlow, Esq., Assistant Conservator of Forests, was printed at the Government press at Mysore; but, as is usual with a great deal of valuable information on India, the paper in question was as much lost as if it had never emerged, in any shape, from the dusty shelves on which such documents generally repose. And here I may again repeat the urgent need that exists for collecting and putting into an available shape all manner of information regarding the resources of the different countries of India. Year after year information is collected merely to be lost or buried in prosy official communications, which go to the Record Office, and are then entombed for ever. The need of a Gazetteer has long been recognised; but what has not been long recognised in India, except the necessity of spending some of the time in acting that is expended daily in talking and Report-writing? Nor need the heads of the different Governments in India wait until a complete Gazetteer can be published. If they would only allow pamphlets to be printed similar to the one that I am now going to make so large a use of, writers on Indian subjects would soon utilise the material provided, and put it into such a shape as to be readily available to the public in this country.

What I am now about to write for a good many pages must be considered as merely an abridgment of Mr. E. Ludlow's Memorandum on Cardamom Cultivation in Coorg. This gentleman, as we have said, held the post of Assistant Forest Conservator; and, as his duties necessarily obliged him to have a thorough acquaintance with all the products of the jungle under his charge, his opportunities of observation therefore entitle his remarks on

cardamoms to be held as entirely reliable. And, first of all, it may be as well to give a general description of the plant.

The cardamoms of commerce, recognised in the British pharmacopœia, and called true or "officinal cardamoms," are the produce of the *Elettaria Cardamomum*, a native of the hilly parts of Cochin China, Travancore, Malabar, Coorg, Munzerabad, and Nuggur. The plant, as the reader will observe, is reed-like, and the capsules are produced on what look like roots springing from the base of the stem. These root-like productions are called *rhizomes* by the botanists, and along the rhizomes, which lie on the surface of the ground, are found the capsules, which are filled with a number of dark brown wrinkled seeds, of a pungent, aromatic flavour.

As we have seen, the seeds are often used to qualify other medicines. The natives of India, I may repeat, chew the fruit with betel, and they also use it in decoction to check vomiting. In infusion these seeds are used to allay coughs. They are also, as we have seen, used in confectionery, although not to any extent in Great Britain; but in Asia they are a favourite condiment, and in the North of Germany they are used in almost every household to flavour pastry. The unripe capsules are, besides, a pleasant addition to Indian chutnees.

The seeds depend for their qualities on a peculiar pungent essential oil, called oil of cardamoms, about 4 per cent. of which may be obtained from them by distillation; and which, when fresh, is colourless; but, if kept for any length of time, this oil loses its odour and taste. The seeds also contain fixed oil 10·4 per cent. Alcohol extracts from them 12·5 per cent. of an acrid burning

resin and extractive matter, the lingin amounting to about 77 per cent. Other kinds of cardamoms occur in commerce, but none are equal to the true cardamom in value, and those produced in Ceylon, Java, and on the eastern coast of India are of an inferior kind; and though the plants producing them have much general similarity, the different kinds of candamoms differ not only in strength, but in the character of their aroma.

The Coorgs relate that in the olden time the cardamom-plant was seldom to be met with in their jungles. The seeds, however, from their value and varied uses, were eagerly sought after, and it soon occurred to the people to imitate those processes in nature which seemed to create the plant itself, or at least to increase the numbers which spontaneously sprang up. Nor were they long in observing that where a large tree had been blown down by the wind, or wherever a huge branch, by being broken off, had let sunlight into the forest, an immediate growth of the valued plant took place; and when either of these accidents of nature took place in the months which immediately preceded the falling of the annual showers, which usually fall in March and April, it was seen that an unusually large growth of plants generally resulted. To imitate these processes of nature was easy and simple, and accordingly the Coorgs cleared away the underwood, and during the months of February and March felled here and there a few large trees. These simple operations were immediately followed by a large growth of cardamom-plants; and thus was cardamom cultivation established in Coorg, and with little or no modification it has been carried on to the present day.

And here I cannot help pausing for one moment to

remark on the singular fact that this simple operation should never have been discovered in the district of Munzerabad, which lies contiguous to Coorg, or that, having been known, it was never followed up, except by a few natives at the foot of the ghauts. The natives of Munzerabad, it is true, are not so enterprising as the Coorgs, but this fact seems hardly to account for such a curious circumstance; and the entire absence of any effort to produce the plants is probably to be traced to the fact that Munzerabad was in an out-of-the-way corner, and that, though so near to a cardamom-growing country, the want of any intercourse between the two peoples was the cause of one of them neglecting what was actively cultivated by the other. The progress of coffee-planting, too, I may here observe, seems to have been extremely slow in Munzerabad, though much attention to the growth of the plant had been long paid by the natives of the Nuggur country to the north. But these facts are, after all, no more surprising than that good farming should exist in one county, and bad farming in another,—a thing that is common in England, though, considering the circumstances, much more difficult to explain.

To return to the cultivation of cardamoms in Coorg, I may continue my remarks by noticing that it has been found in that country that the plant grows in the greatest perfection in a light layer of vegetable mould resting on decayed primary rock. It luxuriates near to streams, and in places often enveloped in mists and fogs. Moisture and shade are essential to its growth, but a certain proportion of sunlight, in order to make the plant grow strong and stout, and yield good fruit, is equally necessary. Elevation is also said by Mr. Ludlow to be necessary, but he omits to state the elevation above sea-

level which seems most advantageous to the growth of the plant; and though, in my remarks upon cardamom-growing in Munzerabad, I shall be able to furnish the reader with a few hints upon this point, I should have been glad to have been able to supply the results of a more extended experience than I can boast of. The aspects most favourable to the plant are northern and western ones; and I may here refer the reader to my remarks as regards aspect in the chapter on Coffee, as both plants require plenty of light as well as shade; and the preference given in Coorg to northern and western aspects is, no doubt, founded on the same reasoning that induced me to give them the preference in treating of coffee. Though feverish, as indeed all jungly countries are at certain seasons of the year, the time for clearing the forest, and also for picking the cardamoms, is healthy enough; and during the most feverish periods of the year there is little or nothing to be done. For felling, strong, able-bodied men are, of course, required. For picking the crop, however, women and boys will do; but women seldom work in the cardamom jungles, though they are often to be met carrying food to their husbands, who, for many nights continuously, have to sleep in huts which are built in the depths of the forest. The coolies in Coorg are provided with tools, and with a daily allowance of rice, curry-stuff, salt, oil, tobacco, betel-leaf, and chunam, and are, besides, paid at the rate of nearly eleven shillings a month. These rates certainly seem to be unusually high, and it seems that the rate for picking is the same as the rate for felling; for though the work of felling is incomparably harder than that of picking, the jungles during the picking season are infested with leeches, and abound with

numbers of venomous snakes. To keep off the leeches the people smear their legs and feet with a mixture of lamp-oil and the bruised seeds of the sampagee-tree (*Michelia Champaca*, Linn.), and rubbing the legs and feet with tobacco-leaves is also of use in preventing their attacks. These leeches are certainly the greatest of plagues in the jungle countries, and more particularly abound in the wetter parts of them. They are extremely small and thin, and vary in size from about a quarter of an inch to an inch in length. They get in between the toes of the people; and though the smaller ones leave but a small mark behind them, the larger ones leave marks of considerable size. On the following day after being bitten, there is an irresistible disposition to scratch the places that have been bitten, and as dirt not unfrequently gets into the bitten part, a nasty sore commonly results. These leeches easily go through any kind of socks, except, perhaps, closely-knit and quite new cotton ones. If bitten, the best plan, when you get home, is to get some common native tobacco, and with it rub all the wounds until they bleed pretty freely, which will have the effect of allaying all the irritation and disposition to scratch the wounds. I have done this repeatedly, and always with the best effect; but in this case prevention is better than cure, and either leech gaiters or two pairs of long cotton stockings should be worn. Some people are more liable to be injured by these leeches than others, and for years I never experienced any inconvenience from them; but, at last, one out of a number of bites I once received turned into a nasty sore, which gave me a great deal of trouble. Cases of this sort are imagined to arise from the leech having been previously feeding on some noxious substance; and I think this

may probably be the case, as few people who have been much bitten manage to escape with a sore such as I suffered from. The activity of these leeches, and the rate they get over the ground, are very surprising; and if you go into the jungle at any time of the wet weather, you will see them making towards you from a distance of two or three yards. I have always been puzzled to know what becomes of these leeches during the dry season. At that time of the year you never see one, nor do they exist in the soil that I can discover, as in digging land several feet deep we find no trace of them; and yet, after months of dry weather, if we have a few hours' rain for several days in succession, the jungle will literally be found swarming with these troublesome pests. But it is time now to return to cardamom cultivation in Coorg.

In Coorg, "Thimmachah" is the god of the forests, and the Kudiyas, a race of jungle tody-drawers, the only inhabitants of these forests, are his priests. The Coorgs will never fell a tree after two o'clock in the day, believing that the offended god would cause the tree to fall in the wrong direction, and that no plants would come up; nor will they commence any new work on a Sunday, reckoning it very unlucky to do so. Tuesday and Friday are considered by them to be auspicious days. When making new plots in their jungles, after a large tree has been felled, they pick up some of the chips lying about the stump, place them on it, and walk quietly away. They believe that the pleased god then approaches and scatters the cardamom seed over the newly-prepared land. The Coorgs have many signs by which they are more or less influenced when selecting sites for new gardens. Many, however, know the good

jungles by tradition handed down from their ancestors, who had a much more intimate acquaintance with them than the present generation; for in old times, when the Coorgs so long and obstinately resisted both Hyder Ali and his son Tippoo, the people were often obliged to quit their houses and fly for safety into the recesses of their forests. But in doubtful jungles the practical test of felling a few trees by way of experiment is commonly resorted to. These are cut down in the month of February, and the growth of plants near the felled trees is a sufficient indication of the capabilities of the forest. But there are other ways of arriving at conclusions as to whether land is suited to cardamoms; and, as it is evidently of importance to collect tests which do not require time and labour, I think it advisable to enumerate those plants and trees the presence of which have been found to indicate cardamom-growing capabilities.

The first plant which calls for attention is the wottee, the only species of bamboo that grows in cardamom jungles. Of this plant there are two kinds, the nool-wottee and the kul-wottee, and, if these grow luxuriantly in the jungle, it is considered by the Coorgs a good sign. Mr. Ludlow, I may here observe, lays no particular stress on the word luxuriantly, nor does he observe that this species of bamboo grows fairly well in forests unsuited to cardamoms. Now, in some of my land which is quite out of the cardamom range, I have found considerable quantities of this species of bamboo, though not growing in a very luxuriant state; and as persons looking for cardamom lands might be induced to attach too much importance to the presence of wottees, I think it of importance to point out that unless these plants are found to be growing in very great profusion,

and with great luxuriance, their presence should not be considered as a very decisive test. Another plant which is especially found in cardamom jungles is the chikka-yelè, which, when young, much resembles the cardamom-plant. Mr. Ludlow, however, does not give the botanical name. I rather think that this plant must be the same as what is called Cogul-yelè in Munzerabad, a plant that any one might, at a little distance, readily mistake for a cardamom-plant. The durbe-kole—a tall, handsome tree, with masses of long, drooping leaves—is also mentioned, but the botanical name is again omitted. Of other trees he mentions the poon (*Calophyllum elatum*), ebony (*Diospyros ebenum*), the dupada (*Vateria Indica*), and several other resiniferous trees. The wild nutmeg and the wild pepper are also commonly to be found in forests suitable to the growth of cardamoms. There is another plant also which is rarely found except in good cardamom forest, called the angaree (*Laportea crenulata*), the leaf of which, if touched, gives a severe sting, and the pain lasts for several days, accompanied by pains in the armpits and chest. The best remedy for the sting of this plant is to rub chunam (lime) at once into the affected part.

I now purpose giving a regular account of the way in which cardamom plantations are formed by the Coorgs; and in doing so I shall use Mr. Ludlow's language almost entirely, omitting here and there only such Indian terms as are likely to be unintelligible to the English reader.

Some time, then, in February or March, the felling party—one-half of them provided with axes, and the rest with large hacking-knives for clearing the underwood—proceed to the forest with the necessary supplies

of food, and commence operations by building near to some stream a temporary hut to shelter them at night. The next morning, the head man of the party, who is necessarily well acquainted with the forest, and who has previously chosen the sites for the projected gardens, points out to the coolies the trees that are to be felled. Half of the party then commence to clear the underwood, while the remainder set to work with their axes and fell the large forest trees. The Coorgs have an idea that it is of great importance that the ground should be well shaken by the fall of some heavy tree, and if from any cause a tree does not crash down with sufficient force, they fell another across it. Each plot generally consists of about the tenth part of an acre, and care is taken to leave about twenty to thirty yards of jungle between each garden, as well as not to make too many gardens in one year, lest there should be a too great and sudden diminution of the moisture which is so much required by the cardamom-plant. From fifty to one hundred gardens are made annually, until the whole jungle is under cultivation. If represented in a plan, a cardamom jungle fully cultivated would be not unlike a checkered board.

In May, during the early rains of the south-west monsoon, the young plants shoot up all over the cleared ground, but especially near to the roots and stem of the fallen tree. By the October following they will have grown three or four inches, and by the ensuing February will have attained a height of about one foot, with from eight to ten leaves on each plant. The seeds ripen in October, and in the fourth year, or about three years and a half from the springing of the plant, a small crop, called by the Coorg "God-fruit," will be gathered. At

this time each rhizome will have thrown up about eight stems. After the plants have grown to the height of two feet the gardens must be annually weeded. When trees have reached the height of about four feet, or say in the third year, a little culling will be required, for each plant must have six feet of clear ground left around it. In removing superfluous plants, care must be exercised in preserving the strongest and healthiest-looking specimens. In the fifth year the plants will give a good crop, and will probably continue to do so for the following seven years, when they will begin to present a sickly and exhausted appearance. It will then be necessary to select some large trees from the surrounding jungle, and fell them right across the sickly plots. This is generally done during the months of February and March, when the lands were originally prepared for cardamoms, but may also be done with great advantage some months earlier. Young plants will then spring up as before, and many of the old plants will have their stems and racemes killed by the fall, but from their rhizomes fresh stems will shoot, and the plants will bear with increased vigour for the next eight years, when the same process of renovation will have to be gone through again. The year in which the forest trees are thus felled into the cardamom plots naturally gives but little or nothing, and during the ensuing year but a light crop will be gathered. But this very much depends upon the quality of the soil, and on this also depends the early or late coming into bearing of the original garden. A cardamom jungle, if thus carefully worked, never becomes exhausted, and the cultivation may be continued on the same land for an indefinite period. One rhizome will often have over

twenty stems, and, as these die off (and they seldom last longer than seven or eight years), fresh ones spring up to supply their place.

The fruit is occasionally borne on the upper part of the stem,* but this is extremely rare, and I may mention that in Munzerabad I have never seen or heard of an instance of this departure from the ordinary habit of the plant. When from one stem four racemes are thrown out, it is called by the natives the true or full crop; if three only, three-quarter crop; if two, half crop; and if one only, quarter crop. One raceme will have from eight to fourteen branches, and each branch from three to six pedicels. When the plant is grown under the most favourable conditions, these branches are grown close together; when, however, the conditions are unfavourable, the racemes are long and weak, and the branches far apart.

Having thus seen how cardamoms are grown by the Coorgs, I now purpose employing a little space in describing the way the seeds are gathered and prepared for market.

In the month of September, then, or early in October, the cardamom-gatherers start for the forests, and as rain may be expected, or at least some heavy showers, in those months, the first thing they do is to build a well-thatched hut. On each side of the hut are erected rough jungle-wood beds for the people to sleep on, and

* It seems to me that one of the first things to be done towards improving cardamom cultivation is to propagate the variety which produces seeds on the upper part of the stem. It is obvious that the yield per acre can never be very great as long as we have to depend on the ordinary way in which the plant bears; but if we can procure plants which will bear above as well as below, the cultivation would at once be placed on a much more satisfactory footing. Another advantage will be that a portion of the seeds would not be so liable to the attacks of rats and vermin as they are at present.

in the middle a pit is made about four feet square and three feet deep. The sides are covered with leaves, and around the top stones are placed to prevent dirt or earth falling in. This pit is to receive the cardamoms when picked off the racemes. The crop is gathered before it is fully ripe, as, if left until quite ripe, it is liable to be eaten by snakes and frogs; and, besides this, the capsules, if ripe when picked, are liable to split when undergoing the process of drying. The workmen are formed into two parties: one goes in front with large knives to clear the gardens of weeds and the shoots of young trees, and at the same time the cardamom-plants are cleared of dead stems. Everything having thus been prepared, the gatherers then set to work and break off the racemes close to the stem of the plant. When their baskets are well filled, the people return to the hut with their loads, and place them down near the pit. This work goes on all day, and, after they have had their evening meal, the seeds are picked from the racemes, and thrown into the pit. This work often keeps the men employed up to a late hour. On the morning following, the cardamoms are measured, put into bags, and sent to the drying-ground. Near to the drying-ground there must always be some shed or house into which the cardamoms can be removed in case of rain. The seeds are dried by exposure to the sun, and are spread out for that purpose on large bamboo or date mats. Those nearly dry are never allowed to get mixed with those still green. Four days' strong sun is quite sufficient, and great care must be taken not to leave them too long in the sun, as the capsules, if over-dried, are very liable to split. The moment they split, the small brown-black seeds, of course, fall

out; and as the seeds, when unprotected by the pod, soon lose their aroma and fall in value, the loss entailed in consequence of the capsule splitting is therefore considerable. Should rain fall continuously,—a thing very liable to happen when the season is an early one,—the cardamoms have to be dried by the smoke of wood-fires. This turns them of a dark colour, and lessens their value. Cardamoms dried in the sun are of a yellowish-white colour. Mr. Ludlow tried the experiment of tying up a few racemes, with their branches and capsules, in a room with a good current of air, and found that the result was very satisfactory. The cardamoms took, of course, longer to dry than if they had been exposed to the sun, but there was no perceptible difference between them and the best sun-dried ones. And this plan, I may add, would certainly, it seems to me, lessen the risk of the capsules splitting, which I should think they would be very apt to do when suddenly exposed to the fierce rays of a tropical sun.

After the cardamoms are dried the fruit-stalks have to be removed, and the following process is resorted to:—Two men sit on the ground opposite to one another, and place their legs so as to form a kind of hollow between them, into which a small, strong, round bamboo basket, slightly hollowed, is fitted. Into this another man feeds the capsules. The two men seated on the ground then rub the capsules with their open hands against the sides of the basket, and by this process they are freed from the stalks. This work is very trying, and unless the coolies wear a veil over their faces, the dust, which is very pungent, makes them ill. Nor can it be performed in rainy weather, as the capsules absorb moisture very freely, and, if they were subjected to this process when

damp, would be spoilt. After this, the women carefully separate the refuse and the empty capsules from the seeds and full capsules, and the seeds are subsequently separated from the capsules by hand-winnowing. The different qualities of capsules should also be separated from one another, or, in other words, should be carefully garbled, for by thus separating the good from the bad a much better price is obtained than could otherwise be expected. The thorough cleansing and preparing of the capsules is of the greatest importance to the cultivator; and this, I may remark, is equally true of coffee and all other products. After being fully prepared for market, the cardamoms are put into baskets and kept in a dry room, to which the wind has but little access. This is done to preserve their aroma. Cardamoms lose in weight and shrivel in bulk by keeping, and it is therefore an object to the cultivator to dispose of them as soon as possible.

Rain is essential to the cardamom-plants, and a heavy monsoon is good for them; but they derive particular benefit from the partial showers that sometimes fall in January, more especially if these are followed by others in March and April. The old people in Coorg say that in former years the rainfall was very much heavier. Mr. Ludlow thinks that this notion may be attributed partly to the fact that the people were not so well off in former days, and, being often obliged to be out in all weathers, thought more of the rain that fell than they do now, when they can afford to spend more time at home. But I have heard the same thing said as to the lessening of the rains in the contiguous county of Munzerabad, and I have the following reasons for supposing that the idea is correct; for, notwithstanding that

the monsoon seems to rain on, with only occasional breaks, and with apparently little to distinguish one part of the rainy season from another, the natives have names for each rain, and divide the whole monsoon into periods, each one of which has its own name. Sometimes these periods are divided from one another by a break, or, in other words, a few sunshiny days, but it is difficult to conceive how they managed to hit upon divisions or distinguishing signs first of all. But, however all this may be, it is certain that many rains, the names of which still survive, and which fell towards what is now the wind-up of the south-west monsoon, often do not fall at all now, or come down in the most infinitesimal quantities. And I have also heard it asserted that birds which were formerly to be seen only in the driest portion of the district are now to be frequently met with in the wettest parts of it. As regards this matter of rainfall, I do not think it necessary to say anything more here, as I have already alluded to the subject in a previous chapter. Mr. Ludlow, I may add, admits that for the last four or five years (he writes in 1869) there had certainly been an unusual diminution in the rainfall; and he is of opinion that plants which, like coffee, require much moisture, have not nearly as good a chance of thriving in the open as they had six years ago.

The cardamom-plant, it appears, has many enemies. Before they ripen, a small grub sometimes attacks the capsules, and should these be at all injured, the seeds they contain are sure to decay. After the seed is ripe, snakes of the "Mandala" species feed on the capsules. They ensconce themselves at the foot of the plant, and often bite the coolies who are engaged in gathering the

crop. These snakes are killed in great numbers every year during the picking season. Frogs and squirrels also eat the fruit, and porcupines attack the stem of the plant. When elephants visit these jungles they do considerable damage, but with the advance of civilisation the numbers of these animals have decreased, and their visits to the cardamom forests are extremely rare. The blanket-caterpillar, which has its body covered with long hairs, abounds in these jungles, and its sting is very painful.

Many conjectures have been made with regard to the spontaneous growth of the cardamom-plant, and it may be remarked that the growth of many other plants is equally surprising and unaccountable. When a piece of jungle is felled, thoroughly dried, and set fire to, the soil seems to be burned right through and through, and even large logs are often partially consumed. And to give an idea of the effect on the soil, I may mention that an iron peg, driven into the ground so that not a part of it protruded, was found, after the jungle had been burned, to be no less than six inches out of the ground.* But even after fires of the most extraordinary severity an immense variety of plants, and shrubs, and trees spring up with the first shower of rain, and perhaps not a few weeks after the land has been burnt off. Of these, the best known is the charcoal-tree (*Sponia Wightii*), which is not found in any old forest, but which springs up invariably wherever jungle is felled and burnt. Indeed, a fire seems absolutely essential for the production of this particular tree, as you may clear down forest, or at least cut down the underwood,

* *Vide* "The Borer in Coorg, Munzerabad, and Nugger," by Colonel C. P. Taylor.

and, by felling trees here and there, let in plenty of sunlight, and yet, under such circumstances, I have never known a charcoal-tree to spring up. On this subject, however, the reader will find some remarks in my second chapter, and in the chapter on Coffee, and I therefore pass on to Mr. Ludlow's conjecture as to the spontaneous growth of the cardamom-plant.

The cardamom-plant, then, according to Mr. Ludlow, can be easily grown from seed, and it also admits of transplantation, but will not last long except in a thoroughly congenial soil. One fact that seemed particularly striking was the total absence of young plants in any old cardamom plots, notwithstanding the great number of seeds that must annually fall on them. Mr. Ludlow's opinion as to the spontaneous growth of the plant is that the soil of all cardamom jungles contains the seed in abundance. By felling a tree, when making a new plot, we admit the sun, and the ground, being well shaken by the fall of the timber, is opened up to the action of the air. The admission of sunlight then raises the temperature of the soil to the point at which the seed will germinate. The cutting and drying of the brushwood, which probably draws from the soil those nutritive particles required by the plant, gives it a fairer chance of flourishing. In about seven years the plants would appear to have exhausted the soil. It will be remembered that the only process of renovation practised by the Coorgs is to fell another large tree or two across the worn-out plots. This, of course, smashes the plants, and prevents their bearing for one year. The ground has, therefore, the advantage of lying fallow for a year; and the tree that for years has been drawing from the soil probably the very particles the cardamom-plant

requires, decomposes, and returns them again to the soil and the surrounding plants, which causes them to flourish anew. When this stock of manure is exhausted, a fresh stock must be given, or, in other words, another tree must be felled. Some attribute the growth of the plants, after the felling of the large trees, to the fact of seeds having been deposited in the hollows of these trees by birds; but though there is every reason to believe that snakes, squirrels, and frogs facilitate the dispersion of the seed, it is not known or thought that birds eat the fruit at all. Besides, if this theory were correct, decayed trees, as containing the most hollows, would be the best to fell, whereas the soundest trees are invariably selected.

I confess that this theory of growth that Mr. Ludlow has adopted seems to me far from satisfactory. No evidence is adduced to show that jungle soils are originally stocked with the cardamom seed. And it may be observed, further, that Mr. Ludlow himself was particularly struck with the absence of young plants in the old cardamom plots, which must have been fully stocked with seeds from the old plants. And when we come to consider that the conditions for germination must at least have been equal to those that existed when the land was first cleared, and the original plants spontaneously sprang up, it seems to me that this theory of the first plants springing from seed is untenable; nor have I been able to discover that the causes of the spontaneous growth of cardamoms have as yet been even approximately traced.

I shall now conclude my remarks on the cultivation of cardamoms in Coorg with a few observations, or rather suggestions, of Mr. Ludlow's regarding the improvements that should be effected in growing the plant.

Irrigation under shade would, he believes, be of great advantage to the plant, for it luxuriates near to running water; but no amount of water, it must clearly be understood, can make up the absence of shade. The vacant places in the cardamom plots should also be carefully filled up, and this should be done either by transplanting seedlings, of which in many spots there is a superabundance, or by propagation by tubers, which Mr. Ludlow has found to be the quickest method. The pits should be made after crop time, the seedlings put in during the month of July, and tubers in early rains in March and April. By continually felling trees the jungle is apt to be exhausted, and it is now time that this rude system of fertilising the soil, and so renovating the exhausted plots, should be abandoned, more especially as this felling of trees across the plants deprives the proprietor of a crop for at least two years. The application of manure ought to take the place of this primitive method, and, where manure is not procurable, the plants should have the soil around them dug to the depth of eighteen inches, and a portion of this soil should be removed, and its place supplied by fresh vegetable mould from the surrounding jungle. The rootlets would soon avail themselves of the proffered nourishment, and the plants might thus be kept in full bearing condition for an indefinite number of years. In plots where too much sun has been admitted, a few jungle trees should be allowed to grow up, those being selected that would yield that slight degree of shade which seems most advantageous to the plant. But the degrees of shade must, of course, be regulated by the exposure, and especially by the climate of the particular locality. It is recommended, also, that pieces of metal, stamped with numbers in Canarese and

English, should be affixed to a tree in each plot. This would facilitate the owner in supervising his workmen, and would insure the ready comprehension of any reports that might have to be sent in during his absence.

I may here mention that, in concluding his Memorandum on Cardamoms, Mr. Ludlow remarks that the climate of Coorg is particularly favourable to the growth of orchidaceous plants, and he is of opinion that the cultivation of the vanilla-plant (*Vanilla planifolia* and *V. claviculata*) ought certainly to succeed in the cardamom forests.

Having thus laid before the reader all the information I have been able to obtain regarding the cultivation of cardamoms in the adjacent district of Coorg, I now propose giving the results of our experience in Munzerabad, and also the opinion of those natives who have been engaged in the cultivation of the plant. To commence, then, with the information obtained from the natives, I shall here give, as briefly as possible, the rules observed by them as regards cardamom-planting.

1. Select land that is damp, and, if possible, with a stream or two running through it.

2. In clearing for cardamoms, cut away the underwood and fell a large tree here and there.

3. Burn the underwood when three parts dry, so that the burning may be as light as possible.

4. Pits to be dug a foot deep, and a foot and a half wide, and about three feet apart, and these to be carefully filled with top soil.

5. In cutting the bulb, take sufficient for the springing of three or more shoots, and take great care not to hack or injure the bulb in any way.

6. The part cut off for transplanting is not to be planted deep, nor are the shoots to be cut.

7. Should the new shoots hang down, they are to be tied together and a support given.

8. The plants to be regularly weeded.

9. When the plant comes into bearing, all the racemes should be laid out above the fallen leaves and rubbish.

10. In clearing wottee swamps (the wottee is a species of bamboo which grows in clumps), a clump of wottees to be left at intervals.

11. The stem of the cardamom-plant is not to be heaped round with fallen leaves, mould, or rubbish.

12. After the cardamoms have been picked, the racemes that have borne to be removed, and old shoots to be cut off.

13. The cardamoms to be planted early in the monsoon.

Before commencing to experiment on cardamom cultivation, I first of all gathered the above information; and since then those rules have all been carried out by my manager, and we have seen every reason to be satisfied with the result. The principal difference between this system and that pursued in Coorg seems to lie in the fact that the underwood with us is burnt, while in the Coorg account no mention of burning is made. With us, too, some attempt is made to transplant, and fill up the land regularly; while no such attempt seems to have been made in Coorg. Then the method of picking seems to differ. The Coorgs seem to make a clean sweep at the outset, and at the same time remove the racemes that have borne crop. We pick the ripest seeds at first, and then go over the

clearing a second time, when the remainder of the crop is removed, and the bearing racemes are then taken off.

By the last report I have from my manager in India, he is decidedly of opinion that young plants are much to be preferred to removing bulbs from those that have been long growing. He is also of opinion that, in removing a portion of the bulb, as much should be removed as to give three or four shoots; so that, in case one should rot, you would have the others to fall back on. Another reason for doing this is that the eyes on the bulb lie so close together that, if you tried to remove only one, it is probable that the coolies would injure several in cutting it out, and you would, therefore, lose the mother-plant, and run every chance of losing the one removed for transplantation.

We have as yet made no attempt at manuring the plants, as what little we have planted have borne little, and do not seem to require it. Nor have I ever heard of an attempt being made to manure this plant otherwise than with the vegetable mould, or top soil of the jungle. There are, besides, considerable difficulties in the way of manuring, on account of the rugged nature of the ground in these jungles, and the consequent difficulty of transporting manure of any sort. Nor does it seem to me that a light seed like the cardamom can remove so much from the soil as to call for any other manure than the vegetable mould which can be so readily procured.

I have said that the causes of the spontaneous growth have never even been approximately traced, and it certainly seems to me that it would be difficult to find a more fanciful product of nature. Why it should be

frequent in one jungle, and why it should be totally absent in another only a few miles distant, and of the same elevation, seems difficult to explain. And there is an instance of this close to the very land I am at present planting. My manager attributes it to the fact that the jungle in which none are to be found was cleared for grain-planting by some jungle tribes many years ago; but, considering that these tribes always select the slopes, and would naturally leave untouched those swampy pieces of ground in which cardamoms most abound, I do not think that the clearing could have had anything to do with the absence of plants. And it is equally puzzling to find that you may remove this plant only a few miles from the line of country where it is indigenous, and place it under the most favourable conditions, without being able to arrive at a satisfactory result. My principal coffee plantation, for instance, lies not more than four miles—or at the most five—out of the cardamom range, and though the rainfall is certainly a good deal less in inches, it extends over exactly the same period, and the general temperature is, I should say, almost exactly similar; and yet the cardamom-plants that I transplanted six or seven years ago, and put down with every care in a swampy, shaded, sheltered ravine, are reported to be, though alive and bearing, vastly inferior in every respect to those under the most unfavourable circumstances in the jungles where the plant is indigenous. With other trees and plants that I have observed the range of habitat seems not to be so abruptly broken. For instance, the range in which the poon-tree abounds is the same as the cardamom range; but though these trees are not commonly found out of that particular line of country, they some-

times occur at considerable distances from their natural home. But out of their exact range you never meet with such a thing as a cardamom-plant. It may seem to the general reader that I have written to a tiresome length regarding this plant; but I am particularly desirous of pointing out its apparently eccentric (I say apparently, because nothing is eccentric in nature, and eccentricities only exist in our eyes when we have failed to detect and unravel, as it were, the operations of nature) growth, because I plainly foresee that in this cultivation many failures will probably occur if the greatest precautions are not taken with the view of ascertaining the suitability of sites for cardamom plantations.

In the Mysore province the excise-tax on cardamoms was, for some unexplained reason, abolished in 1866; and, for some reason which seems at least equally unintelligible, it was re-imposed in 1868, at the enormous rate of 4*s.* per 24lbs. weight of cardamoms, or, in other words, at the rate of no less than 18*s.* 8*d.* per cwt., a rate upwards of nine times the amount levied on coffee, which is taxed at 2*s.* per cwt.—a tax which was always considered high, and a reduction on which to the amount of twenty-five per cent. was recommended by Mr. Bowring. There was, of course, some reason in taxing cardamoms at a higher rate than coffee, because the article is so much more valuable; and no doubt the high rates that have prevailed for the last few years induced the commissioner to tax cardamoms so heavily. But it is evident that these high rates could never be obtained if cardamom cultivation was extensively carried on; and taking that fact into consideration, I think that a tax of, say, three times the amount of the tax on coffee is the

highest that should be levied. As an instance of the extraordinary fluctuations in the value of this spice, I may mention that some years ago I only obtained 4*s.* to 4*s.* 6*d.* per lb. for cardamoms, while last year, for the produce of the same land, I obtained no less than 8*s.*, and subsequently even a higher rate; but, as was observed by Mr. Crake, if the home demand was once fully supplied, it is evident that prices would recede to the old level. But, supposing that the Government was unwilling to fix the tax at a low rate, they might make it rise and fall with the value of the article. This, however, would be a troublesome plan; and as the revenue from cardamoms is extremely trifling, amounting in 1868-69 to less than £180, and as it is plainly the policy of the Government to utilise all the forests on the frontier, it would be a great encouragement to people desirous of taking to this cultivation if the rate was fixed at a small amount for, say, the next ten years, when it might again be made subject to such a revision as might seem expedient. Another point to be considered, too, is, that though the value of the spice is high, the produce per acre seems, by Mr. Ludlow's account, to be extremely small. He calculates that 28lbs. only can be regularly got from an acre, equal in England, at 6*s.* per lb., to 168*s.*, while, allowing the yield of coffee to be as low as 6 cwt. per acre, the return for that in England would be, at 80*s.*, no less than 480*s.* It may be argued that, as there is no tax on the land, this would not matter; but wherever you get a small value off your acre, you require just so many more acres to work, and therefore your expenses are just so much more. This, of course, is a matter that yet remains to be exactly proved, as no

European that I am aware of has ever taken to cardamom-planting in the way that Europeans have taken to tea and coffee planting. But, unless more favourable terms than those existing at present are conceded by Government, it is hopeless to look for any extension of the cultivation in Mysore. I am the only cardamom-planter at present in the province; and, as no one else has gone into the business, it is plain, now that people are commencing to appreciate better the value of this spice, that the main deterrent is the high taxation. The attention of the Government, I must in justice add, is only now being called to this subject; and had the matter been urged previously, I have no doubt that we should have seen a reduction of the tax by this time. As it is, and taking into consideration that our Governors in Mysore have always maintained the policy of doing everything they could to foster every sort of enterprise in the province, I feel little doubt that cardamom taxation will soon be put on a satisfactory footing.

CHAPTER XIII.

TEA, COTTON, SILK, SANDAL-WOOD, RHEA-GRASS.

THE reader has, I dare say, often heard of tea as the cup that doth cheer, but not inebriate; but I am now going to introduce him to a cup of tea which will do both. There are many curiosities in the way of experiment to be seen in London, but few, I fancy, have seen a cellar all lit with gas, and lined with barrels of tea-wine, and with the orthodox cellarer who serves you with sample after sample, between which the bewildered palate vainly endeavours to discriminate. As I stood in a cellar of this sort about a year and a half ago, surrounded with tea-wines, some more than two years in cask, my very soul overflowed with wonder at the ingenuity and determination of speculators. The cellar assuredly was not got for nothing, nor was the cellarer, nor even the building itself, though it had formerly been a stable; nor, too, the analytical chemist, who had his experimental room above, which was well lighted by a skylight constructed for the purpose. Under the skylight was a large table, with apparatus of different sorts scattered about it; on another table were samples of nearly every kind of tea in glass-stoppered bottles; while, on a third table, were the finest scales in use amongst analytical chemists. And what, it may be asked, set all

this going? Well, some years ago it was found that the public were being choked with tea of one sort and another, spurious and real, and both mixed together. The gentlemen in the tea trade were some of them apprehensive as to the tea-consuming power of the British. One of them applied to the gentleman who subsequently conducted the experiments, and the glorious idea of making the public consume, in the shape of an alcoholic beverage, what they would not drink as tea, was speedily suggested. Hence the cellar full of tea-wine. The result obtained was really wonderful, and the great difficulty of obtaining a dry base* had been successfully overcome. Tea-wines, both dry and sweet, had been produced; and of these the dry wine resembled common Sauterne in colour and taste. Some time after this I attended a lecture on wines in general at the Society of Arts, when the table in front of the lecturer was covered with bottles containing six specimens of tea-wines for the audience to taste at the close of the evening. The attendance was large, and the wines were experimented on with considerable interest. There were dry wines, sweet wines, and champagne tea-wines, the corks of which were duly cut, and the foaming beverage duly found its way down the throats of those who felt inclined to experiment on the effects of aërated tea-wines. As for myself, I could not help being struck with the active interest displayed by the tasters. They smelled and tasted, and then tasted and smelled. Two gentlemen in particular attracted my attention; and I heard one say to the other, "Just you come down to our office to-

* When a dry base is procured, or, in other words, a liquid which has what is known as the dry quality in wines, you can then proceed to the manufacture of almost any wine.

morrow, and I'll show you." Here the remainder of the conversation became inaudible; but the truth at once flashed on me that these people were not evincing such interest for nothing, and that I was surrounded with the true genius of the British adulterator. Though these conclusions might possibly have resulted from an active imagination, it is certain that the tea-wines did not, or, if they did, they were at least accomplished and stimulating facts. But was it not possible to improve even upon them? was a question which next arose. They were wines undoubtedly; but might they not be made far more cheaply by substituting coffee-tea at 4*d.* for Congou at 2*s.* per lb.? This is an idea which I make a free present of to the public; and if a combination of tea and alcohol is ever to be drunk, I feel sure that roasted coffee-leaves will supply the sustaining effects of ordinary tea equally well. But the general suitability of roasted coffee-leaves has yet to be experimented on before a decisive conclusion can be arrived at.

And now as to the making of tea-wines. Carefully-selected tea, preferably good Congou and some Oolong, is infused with boiling water, in proportion of half a pound to the gallon. This infusion is effected in a vat with a perforated false bottom, in which the water is heated to ebullition by means of steam. When the tea is made it is drawn off the leaves (which remain in the vat on the perforated bottom), and allowed to run slowly over sugar contained in a sieve, so that every 75lbs. of tea dissolve 25lbs. of white sugar. To the solution a quantity of yeast (3lbs. to 7lbs. per 100) is added, whereupon it begins to ferment. This process must be conducted with caution, in rooms of equal tem-

perature day and night. When partially fermented the wine is racked, and fined with pure gelatine. Thereupon it begins to ferment again, owing to the removal of tannin, and now assumes character, and gradually becomes clear. In the course of a few months the beverage is ready for use.

There are several other ways of making tea-wines, and amongst them are the following:—The sugar and water are fermented by means of yeast, and a portion of the fermented liquid is infused over tea, and the strong infusion added to the fermented liquid. This process shortens the time necessary for fermentation. Such fermented liquid can also be impregnated with tincture of tea, or tea-liqueur, a delicious alcoholic extract of tea. This is produced as follows:—Tea is made by means of boiling water, and evaporated to extract. This is taken up by the strongest and purest alcohol, filtered, and kept in bottles. It acquires an exquisite flavour. Of this a quantity corresponding to the half a pound of tea mentioned in the first-named method is put into the fermented sugar solution. The effervescent tea, or "thé mousseux," is made like soda-water; viz., it is impregnated with carbonic acid after being finished.

Such, then, is a brief account of some of the methods of making tea-wine, which, as far as can be seen at present, may be made cheaply enough to come within reach of the poorer classes, and may one day help to displace some of that adulterated and drugged apology for beer which is now so largely consumed. But it is time now to say something as to the cultivation of the tea-plant itself.

The tea countries of India are, as I dare say most of my readers are aware, for the most part confined to the

northern and north-eastern regions of India. In the south, though introduced many years ago on the Neilgherry Hills, it never seems to have found favour. Whether this was owing to its having been driven from the field by coffee, or to the fact of tea in Southern India not paying, I am unable to say. I have never paid any attention to the plant myself, though for a good many years I have had plants growing in my garden, and these, I may add, have attained a considerable size. The plant, too, has been grown in Coorg and on the hills in Nuggur, the most northerly division of Mysore. But the only quarter in Southern India where I believe a tea-planter is to be found is on the Neilgherry Hills; and, as it is my intention to confine my observations as much as possible to South India, I shall content myself with laying before the reader, in as brief a form as possible, the leading facts of the cultivation as it at present exists on the hills; and subsequently I purpose offering a few remarks on the results of the experiments that have been made in the little province of Coorg.

In a work entitled "The Neilgherry Tea-Planter," by Mr. James McPherson, the reader will find full information as regards the cultivation of tea on the hills; and I cannot, I think, do better than refer people interested in tea to the book in question. In the meantime, however, and for the benefit of those who may find it difficult to procure Mr. McPherson's book, I shall now proceed to notice two points which seem to me to be of especial interest. The first point has reference to the fact that tea can be grown on grass land; and the second point on which I purpose making a few remarks concerns the probable profits of tea-planting.

And, first of all, as to growing tea on grass lands.

The fact that tea can be grown on grass land at all at once places the plant on a footing which gives it immense advantages over coffee, which can only be grown within certain narrow limits as regards climate and elevation, and which absolutely requires the finest forest land to grow the tree in anything like a paying form. And it must be borne in mind that if, as regards climate, the limits of coffee are narrower than those of tea, the limits, as regards the lands it can be grown on, contract the cultivation to an extraordinary degree. A coffee district is no sooner known than it is absolutely absorbed, and in a very few years clean swallowed up, just as Munzerabad has been; whereas, if coffee could be grown on grass lands, the cultivation might be indefinitely extended. The fact, too, of its being possible to produce tea on grass land seems to show that the plant requires far less from the soil than coffee, and the advantages arising from that consideration need not, of course, be enlarged upon. In passing I may also mention that another point of superiority seems to lie in the fact that the tea-plant is not nearly so liable to the attacks of insects as coffee. In fact, in Mr. McPherson's little work there is no mention of any tea-plant enemy at all; and I should hardly think it possible that any objections on that score would have been passed over, had the liability to blight or insect attack been at all probable.

On the Neilgherry Hills we are informed by Mr McPherson (and my own observation amply confirms this) that the grass lands are very abundant, and often of excellent quality. In many instances six feet or more in depth of excellent loamy soil may be met with